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## Original Communications

### PLACENTAL CIRCULATION*

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THE natural life history of organs is one of constant change, both in tissue organization and cell change. The cyclic changes in the uterine mucosa and striking alterations in the coronary artery circulation with each decade are but instances of this structural fluidity of organs. The proper interpretation, therefore, of any given change lies in its comparison with that of a known age period.

Much of our knowledge of the placenta has been adduced from investigation of the growth, disposition and change in its epithelium, as befits a glandular organ. Comparatively little attention has been directed to the circulatory changes. When one recalls its essential vascular construction, a large glomerulus, as a direct continuation of the dorsal aorta of the fetus, it follows that considerable importance must be attached to the behavior of these vessels.

The main differences between the young and old placenta are the anatomic changes which are aptly termed degenerative, a physiologic vascular senescence. These changes are best seen at term when the placenta is definitely a senile organ barely able to sustain its physiologic activities and soon to be repudiated alike by mother and fetus.

The combination of the x-ray with the injection of the vascular tree of various organs has accomplished much in the elucidation of their vascular architecture. Formerly injection methods were combined with serial sections in reconstructon efforts, but this was confined to the finer or microscopic circulation. Latterly injection plus dehydration has revealed the true nature of the coarse circulation,

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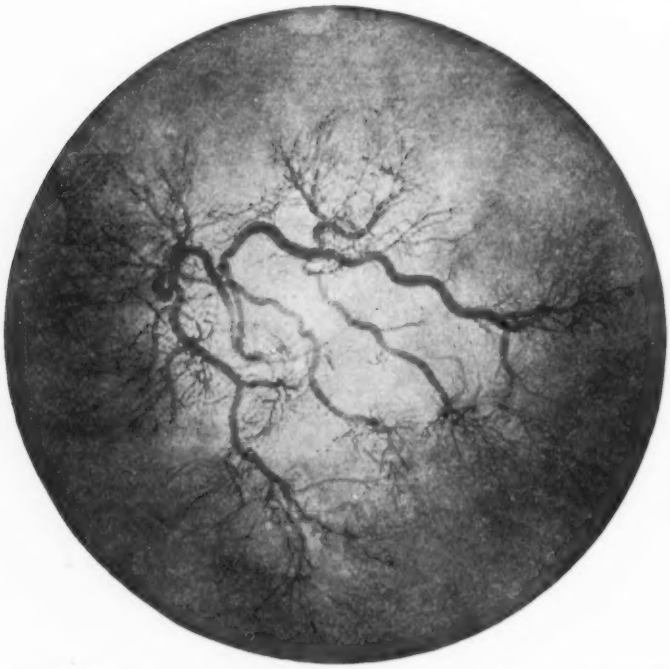

Fig. 1.—Arterial injection 4½ months' placenta, showing large subamniotic vessels.

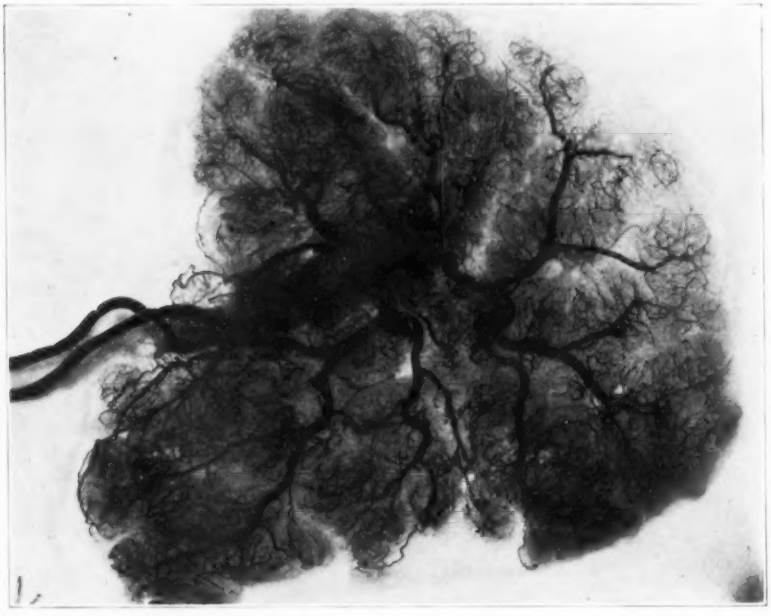

Fig. 2.—Arterial injection of mature placenta showing the large subamniotic branches as well as the finer cotyledonous circulation. The wide spread anastomoses both on the surface of the placenta and in its substance are clearly shown. The large bore of the vessels on the surface is characteristic.

and if to this one adds the stereoscopic radiogram, the whole vascular tree is shown in proper perspective.

The present study was undertaken with a view of establishing the architecture of the healthy as well as the diseased placenta, and of observing the vascular changes in the different age periods. To ac-

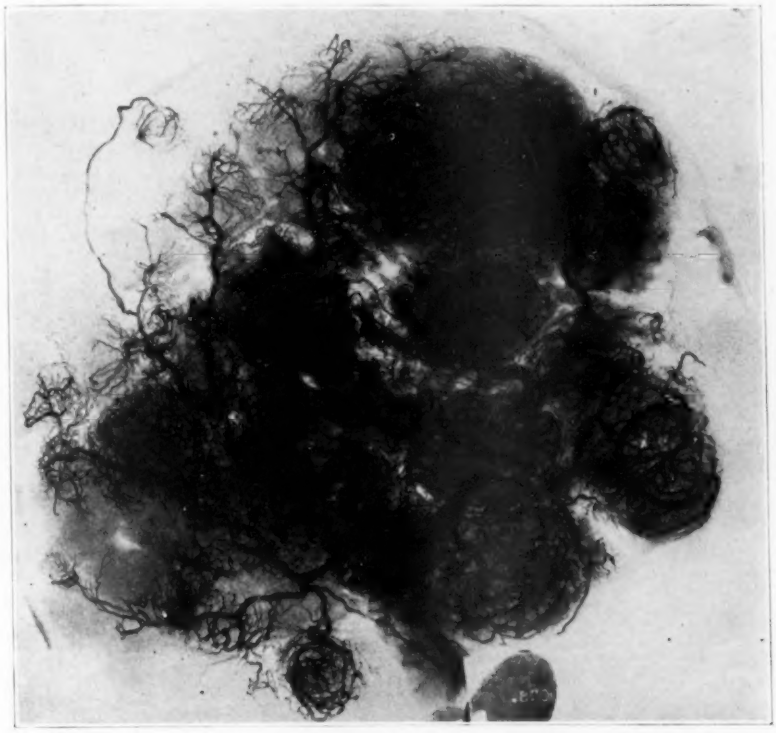

Fig. 3.—A more mature but at the same time healthy placenta showing some reduction in the bore of the large subamniotic trunks, a visible contraction of the cotyledonous circulation with beginning areas of degeneration.

Fig. 4.—Cross section of placenta with arterial injection to show the shrinkage of the cotyledons. The uniform thickness of the placenta is still preserved.

complish this the vascular tree was injected in many placentae of varying degrees of development, stereoscopic radiograms were taken of them, and later these specimens were dehydrated and cleared.

The technic employed requires little mention, the apparatus being similar to that described by Gross in injections of other organs. The

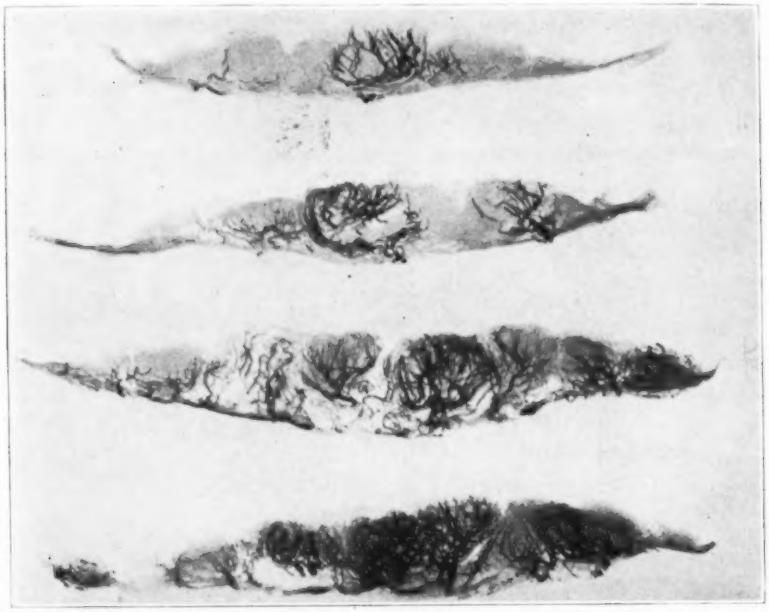

Fig. 5.—Several sections of the same placenta showing the different stages of infarction. The thickening of the fine cotyledonous vessels with a loss of the usual whorled arrangement is clearly depicted.

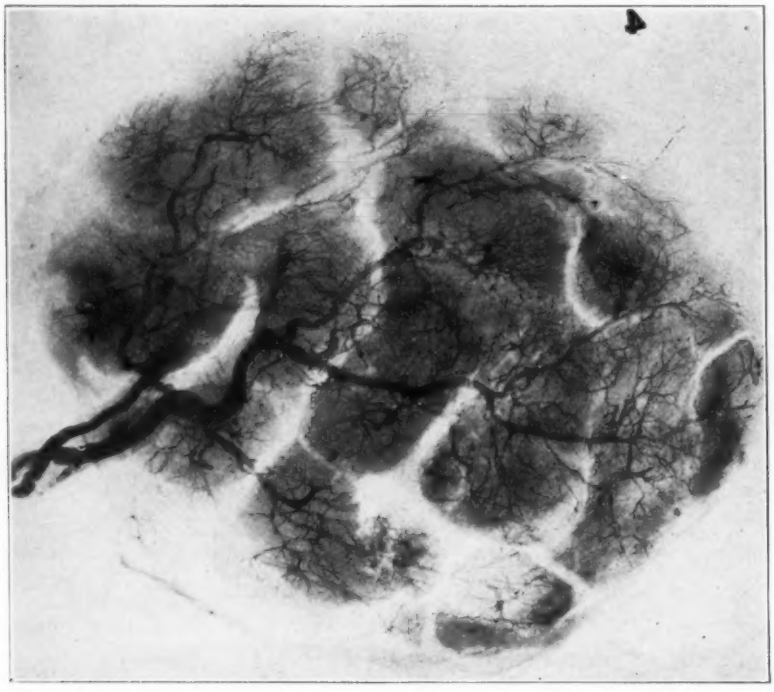

Fig. 6.—Arterial injection of a placenta at term of a healthy child. A widespread senescence is visible in the irregularity of the large surface trunks, the stripping of their many branches and a great diminution in number of the fine cotyledonous vessels. The margins of the placenta are almost deprived of their circulation.

injection mass which seemed most applicable and yielded the best results was barium in gelatin. The specimens were all dealt with in a similar manner. They were obtained as soon as possible after birth, the blood was removed by gentle massage and saline irrigations, as completely as possible, they were then injected at standard

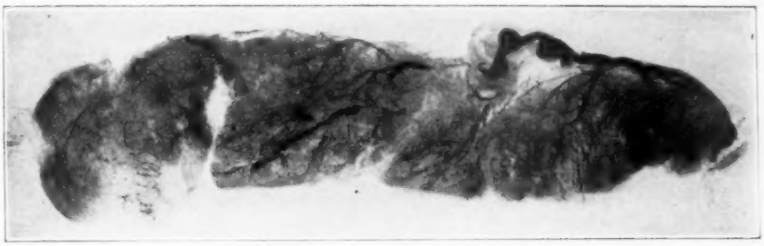

Fig. 7.—Cross section of a syphilitic placenta showing the immense thickening of the placenta itself. The irregularity in the arterial distribution is well shown.

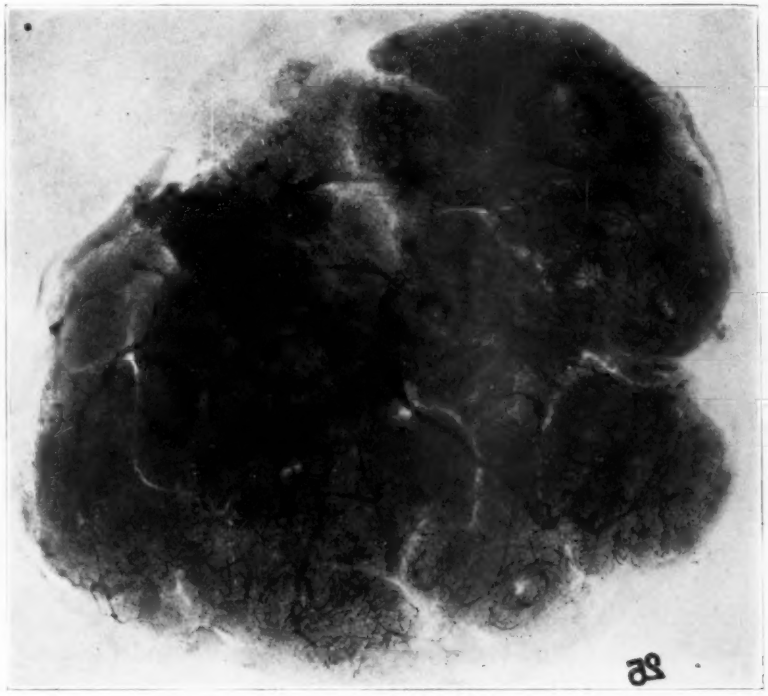

Fig. 8.—Arterial injection of a placenta in nephritic toxemia. There is widespread infarction and extensive vascular degeneration.

pressure and temperature, either by the arterial or venous route, or both, and then fixed by immersion in formalin for 48 hours. Following the x-ray selected specimens were dehydrated and cleared. The uniformity of this method diminishes to a great extent the danger of artefact and permits of some generalization in the final analysis. As

a result of these radiographic observations one may consider the vascular arrangement in the placenta from three view points:

1. That of the young active placenta.
2. That of the mature or ripe placenta.
3. That of the diseased placenta.

1. In the young immature placenta the vascular tree, as Boussin and Brindeau have shown, is regular and orderly in arrangement, the large divisions lying on the fetal surface of the placenta (subamniotic branches) ending usually near the placental margins in the deep or perpendicular vessels, which are to form the mural circulation. The

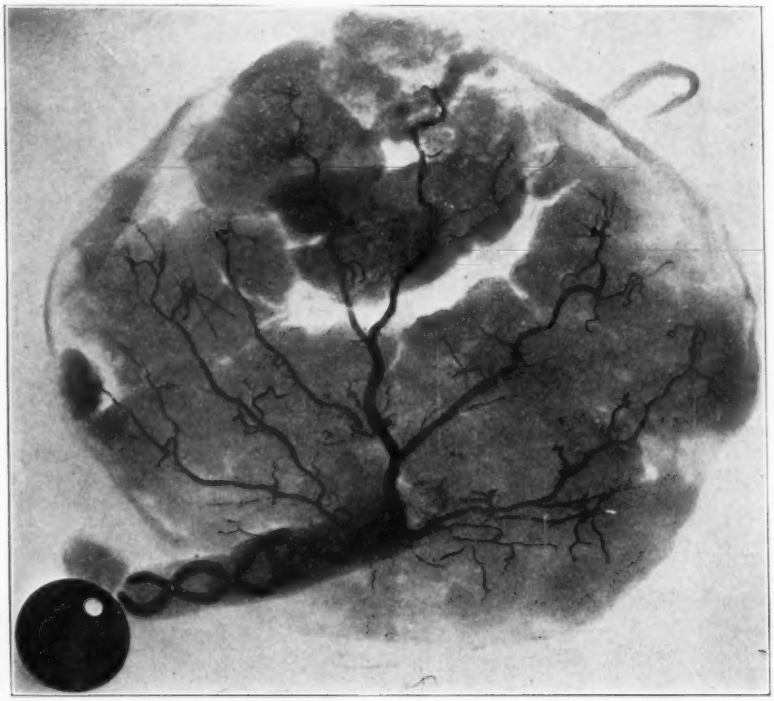

Fig. 9.—Arterial injection of a placenta of a macerated fetus. Circulation is still present in the large trunks.

main arteries as a general rule separate on leaving the cord, and pass one to each half of the organ, less frequently the central portion is supplied by a large artery and the periphery by a smaller one. These vessels, irrespective of arrangement, pursue a tortuous course over the fetal surface, spreading with their branches like the spokes of a wheel to every quadrant of the placenta, disappearing into their respective cotyledons near the placental margins. At times they encircle the edge of the placenta and in the very early stages it is not unusual to see a small branch pass as a loop onto the free surface of the chorion. Hyrtl interprets this as a persistence of the vascularization of the

chorion læve, and is suggestive of the presence even early of a widespread physiologic vascular degeneration. With the dipping of these large trunks into the cotyledons the vessels change rapidly—the bore is rapidly reduced and the vessels rapidly divide into the innumerable lobular branches of the cotyledons. The stereoscope reveals a backward tilting of the vessels toward the center of the placenta.

The ultimate arrangement of the finer vessels of cotyledons has been variably described. The usual outlines are glomerular or tuft-like,

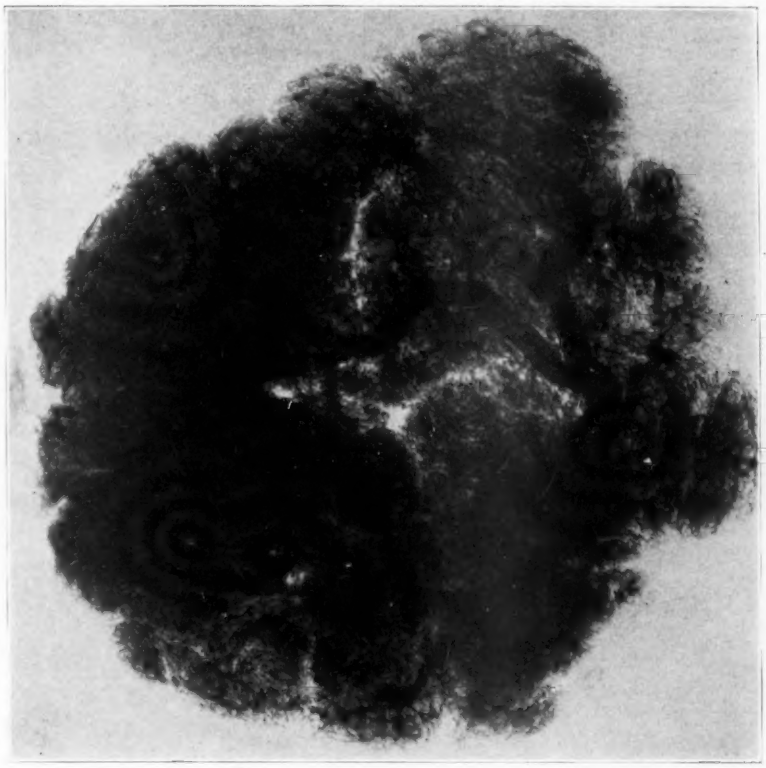

Fig. 10.—Venous injection of a healthy placenta. The cotyledonous circulation is extremely dense permitting of little or no differentiation.

myriads of vessels intertwining each other, in others umbrella-like, while in others they are almost as a palisade. The anastomoses are very free both in the larger or subamniotic branches, and likewise in the deeper substance of the placenta proper. This was early perceived in the rapidity of return flow through the one artery when the other was injected—that this occurs as well in the deeper structures one may note by injection of a large branch near its point of submergence —when the whole structure becomes rapidly injected. A point of interest is the rapidity of return of the saline by the vein when one or both arteries are injected. It has been possible to point this out with

bismuth, one may push the injection mass over from one circulation to the other.

The venous circulation is, as a rule, somewhat simple, the large umbilical vein at the insertion of the cord divides rapidly into two, three, or more branches of varying size. These are the main subamniotic branches, they are at a deeper level than the arteries, more distended and have many finer branches. In a sense they trail the arteries and dip into the substance of the placenta where they freely anastomose with neighboring trunks, and then break into immense clusters of fine vessels which resemble the falling spray of a fountain. This is decidedly more intricate than the arterial display and suggests a wide collecting system. From the rapidity of return flow through veins of irrigating saline it seems allowable to infer the presence of a shallow capillary bed.

2. The mature or ripe placenta shows some complexity of structure, both in the larger trunks and terminal vessels, as well as showing the presence here and there of areas of degeneration, which from their small size and comparatively little effect on the fetus cannot be more than evidence of physiologic senescence.

In the young placenta one emphasizes the regular and orderly arrangement of vascular tree from the large trunks to the terminal distribution. In the riper or more mature one sees the regressive changes; the large vessels at times present a beaded appearance and are apt to diminish irregularly in size. There is a conspicuous diminution in number of small branches or lateral anastomoses.

The arrangement and size of cotyledons are determined largely by the chorionic villi,—speaking generally, each cotyledon corresponds to a villus, which with its branches, fills the cavity of the cotyledon and is attached by numerous anchoring villi to basal plate and septa. It therefore follows that as the villus is largely a vascular structure its size and behavior will be regulated by its blood volume. One finds in these mature placentae a contraction or shrinkage in size of some cotyledons, even though possessed of an indifferent circulatory apparatus laboring under difficulty. It is my belief that this condition of pruning of circulation is responsible for many changes in both fetus and placenta. Again this glomerular or cotyledonous change is frequently associated with stripping of the branches of some of the large trunks prior to their submergence into the body of the placenta, showing that it is not a degeneration of terminal branches in villi but a widespread vascular change. There is no evidence of vascularization of membranes in these mature specimens. This vascular degeneration seemingly plays considerable part in infaret formation.

3. In widespread infarction, retroplacental hemorrhage and indeed in all cases where fetal injury or death has resulted from placental

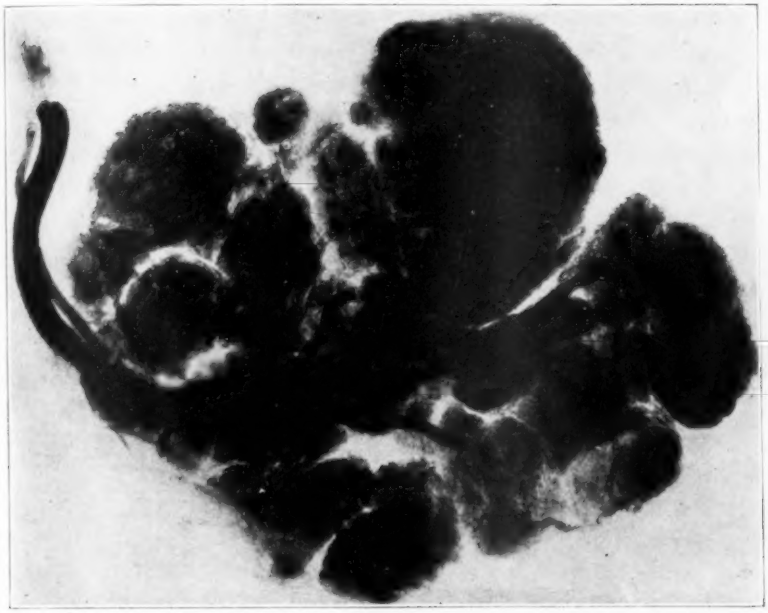

Fig. 11.—Venous injection of a healthy placenta at term. The shrinkage of the cotyledons is clearly manifest.

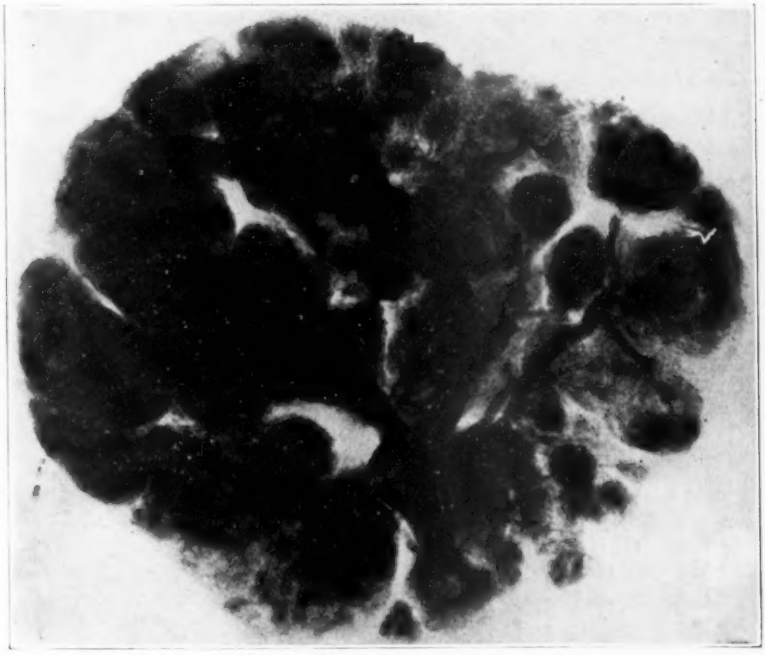

Fig. 12.—Venous injection of a healthy placenta with some peripheral infarction. All gradations, from a healthy cotyledon to one devoid of circulation are to be seen in this specimen.

disease, the changes in the vascular tree are numerous and somewhat remarkable, a change from ordinary senescence to striking vascular degeneration often resulting in deviation of the circulation from large areas, with associated tissue degeneration.

All gradation of degenerative changes are visible in these diseased placentae from those of widespread degeneration to complete destruction of the vascular tree, all stages in the dismantling of the cotyledonous circulation are represented, from a moderate reduction in size with perfect preservation of outline of cotyledon, through stages of very definite reduction in size to those where it is scarcely possible to demonstrate a circulation. The vessels lose their tortuosity, are devoid of fine branches, and show a widespread coarseness which is visible even in the finer ramifications. Functionally dead areas, where no vascular system is demonstrable, are found scattered between these cotyledons; these are the blind spots.

Stereoscopically the placental thickness is shown to be variable, and the organ appears thinner in places, where the vascular degeneration has caused flattening of a segment. It is remarkable how frequently large areas are thrown out of service by these changes. In advanced conditions associated with intrauterine death the only vestige often of a circulation still existant is in the large subamniotic trunks.

From these investigations one must conclude that the placenta, like other organs, is possessed of a youth, a maturity, and an old age.

In the young organ the conspicuous anatomic features are:

1. The orderly arrangement of the vascular tree from the distribution of the main vessels on the fetal surface to their ultimate destination in the cotyledonous areas.

2. The directness of the arterial and venous supply of the cotyledons.

3. The rapid reduction in bore of the large vessels only following submergence into the cotyledonous stems.

4. The abundant lateral anastomoses shown by injection, also by rapid return of fluid injected into one artery with return through the other.

5. The short capillary bed shown by rapid return of saline through vein when injected by artery, serial sections, and by the fact that it is possible to push over the injection mass from artery into vein.

A physiologic senescence is conspicuous in and responsible for many structural changes in the old placenta. This is visible in:

1. Beading and straightening of the subamniotic vessels.
2. The stripping of large trunks of their finer branches.
3. Blind spots in the body of the placenta.

4. Lack of compensatory circulation through diminution of anastomotic network.

5. Marked shrinkage of the cotyledonous circulation with ultimate infarction and cessation of function in some areas.

These observations are in harmony with the work of Williams, Eden, Ackerman and others.

The lack of any material circulation in the white infarcted areas, the presence of physiologic degeneration early as shown in passing of the chorionic læve, the presence of degenerated vessels in fairly healthy villi and the difficulty of pushing over injection mass from artery to vein in old placenta, suggests primary degeneration which may often result in infarction of considerable areas.

In widespread infarction, retroplacental hemorrhage and other conditions where fetal injury has resulted, the degenerative changes in the placental circulation vary from marked vascular degeneration with deviation of circulation from large areas of the placenta to complete destruction of the finer circulation, and usually total loss of function.

There is thus a close relationship between the healthy and diseased placenta, and one ventures to suggest that the ordinary senescence of the mature placenta renders the organ very susceptible to disease processes. The changes in the placenta of growth, maturity, and decay follow each other with great rapidity, and to some extent overlap. After all the life span of the placenta is 280 days, and it is not unusual that the change from the normal to the pathologic should be rapid and often imperceptible.

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670 Sherbrooke Street, West. (*For discussion see p.* 743.)

# BLOOD PRESSURE CHANGES FOLLOWING DELIVERY*

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A SUDDEN drop in blood pressure following delivery was first brought to my attention in 1915 while attending the labor of a patient with a nephritic toxemia, who had pressure of 190/110. In this case, about thirty minutes after delivery the patient developed a cyanosis, became faint, her respirations were shallow and increased and her pulse was imperceptible. After stimulation, with 2 c.c. of pituitrin intramuscularly, raising of the foot of the bed, the application of a tight binder and weight to the abdomen and wrapping the patient up, all of which took some ten minutes, her blood pressure was taken and patient was found to have a systolic pressure of 70 mm. Hg. She recovered rapidly, and in forty-five minutes was in excellent condition.

Since this time I have made similar observations not infrequently, and I soon appreciated that these drops occurred almost invariably in cases of marked toxemia. In going over the records in Barnes Hospital during the last few years, we were able to pick out several cases whose blood pressure charts were detailed enough to demonstrate these changes quite advantageously. Although the cases included in this paper number ten, we feel that this is no index of its incidence because in many instances no blood pressure readings were made for several hours after delivery.

Since 1912 in our hospital service there have been only sixty-eight cases of toxemia of pregnancy with blood pressures of over 150, and because of the frequency with which we have been seeing these drops recently, we feel that they probably occur in the majority of cases.

In studying the histories of these cases, there was present in every instance, severe toxemia, and rapid delivery, a method to which I do not subscribe, was carried out in several instances. It is however, quite apparent that rapid delivery is by no means alone accountable for the drop, as it occurred in just as great degree in several of the cases which were delivered spontaneously, or following easy deliveries.

In consulting our text books, Williams' and De Lee's, we were able to obtain some information on this subject. Under the title of "shock," Williams points out that death from this cause has been mentioned, due to the exhaustion from long and hard labor. He

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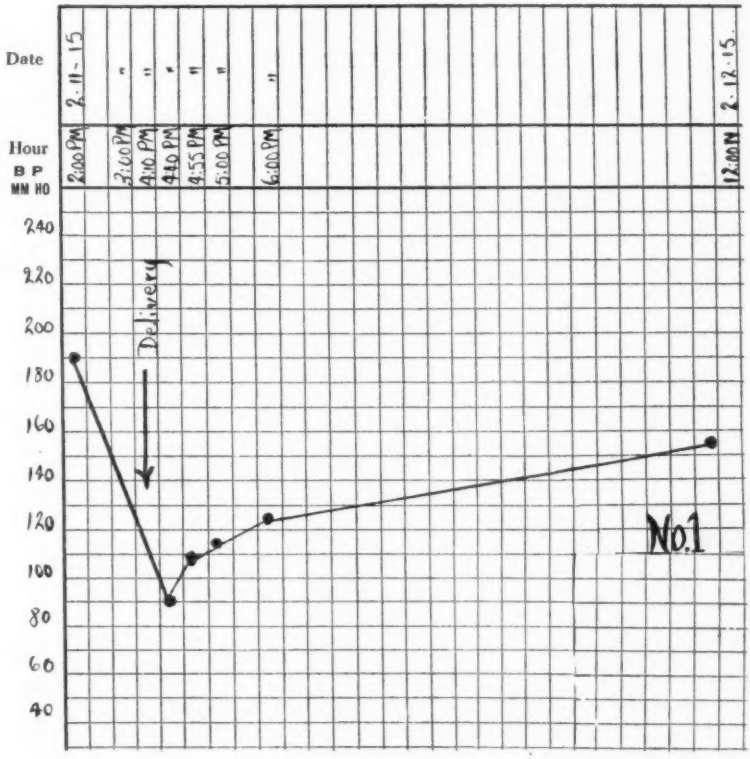
feels that this diagnosis is loosely used and that a well conducted autopsy will usually reveal sufficient cause of death. Under "syncope" he describes serious cases with the patient in profound prostration, with recovery the rule. He apparently does not associate these cases with toxemia or hemorrhage.

De Lee, in describing syncope, states that he has seen two cases of almost fatal syncope in cases of acute uremia and toxemia of pregnancy. He mentions that Zweifel reported a case at autopsy and that Norris reported another. Norris' case, however, died four




days after delivery; death was undoubtedly due to a coincident myocardial lesion. De Lee also, in considering the treatment of eclampsia, states that shock not infrequently follows delivery, and mentions Bailey as particularly emphasizing this point. To my knowledge, Bailey's article "Shock in Eclampsia," which has recently been referred to by Kosmak in his monograph, is the only article that has come to my attention, which treats with any detail this particular subject.

In his article Bailey reports six cases in which marked drops in blood pressure occurred, chiefly due to the use of veratrum viride, but his Case 3 shows a drop in a period of one and a half hours

TABLE I

| NO. | AGE | DATE OF ADMISSION | DATE OF DELIVERY | DURATION OF PREGNANCY | GRAVIDA | DIAGNOSIS | DURATION OF LABOR | CHARACTER OF DELIVERY |
|---|---|---|---|---|---|---|---|---|
| 1 | 33 | Outside Case. | Feb. 11, 1915. | 40 weeks | V. | Nephritic Toxemia | 4½ hrs. | Forceps Perineal |
| 2 | 34 | Jan. 11, 1921. | Jan. 11, 1921. | 34 weeks | IV. | Nephritic Toxemia | Not in Labor | Manual and Bossi dilatation. High forceps |
| 3 | 36 | Mar. 8, 1918. | Mar. 13, 1918. | 40 weeks | VI. | Nephritic Toxemia | 26 hrs. | Spontaneous |
| 4 | 23 | June 26, 1918. | June 28, 1918. | 37 weeks | I. | Eclampsia | Not in Labor | Manual and Bossi dilatation. High forceps |
| 5 | 28 | Oct. 21, 1922. | Oct. 24, 1922. | 40 weeks | V. | Nephritic Toxemia | 28 hrs. | Induction Voorhees bag Version |
| 6 | 28 | Aug. 1, 1921. | Nov. 11, 1921. | 37 weeks | IV. | Nephritic Toxemia | Short. Not aware of labor til second stage. ½ hr. | Spontaneous |
| 7 | | Mar. 9, 1919. | Mar. 19, 1919. | 35 weeks | I. | Eclampsia | Not in Labor. | Vaginal hysterectomy Forceps |
| 8 | 25 | Aug. 4, 1922. | Aug. 23, 1922. | 39 weeks | II. | Nephritic Toxemia | 6¾ hrs. | Induction of labor. Oil and pituitrin. Easy low forceps delivery |

TABLE I

| SCOPOLAMINE MORPHINE | ANESTHESIA | ALBUMIN N.P.N. | CONDITION OF CHILD | CONDITION OF MOTHER | HEMORRHAGE | AUTOPSY FINDINGS |
|---|---|---|---|---|---|---|
| None | Ether at delivery | Alb. ½ gm. per lit. No casts | Living | Recovery | None | |
| 1 injection Gr. 1/133 Morphia 1/6 | Ether for delivery | Alb. 40 gm. per lit. Granular casts | Living | Death three hours after delivery | Slight bleeding one hour after delivery | No Autopsy |
| 3 injections Gr. 1/133 1 injection Gr. 1/300 2 injections Gr. 1/200 4 injections Gr. 1/400 | Ether for delivery | Alb. 9 gm. per lit. Granular casts | Living | Death | None | Normal post-partum uterus. No uterine injury. Chronic diffuse nephritis |
| None | Ether at delivery | Alb. 17 gm. per lit. Many granular & Hyaline casts | Living | Recovery | None | |
| None | Nitrous oxide with small amount ether at delivery | Alb. ++++ No casts N.P.N. 20 mg. | Living | Recovery | None | |
| None | None | Alb. 4 gm. per lit. Granular casts N.P.N. 39 mg. | Living | Recovery | None | |
| None | Ether at operation | Alb. ½ gm. Granular hyaline casts | Living | Recovery | None | |
| Scopolamine over 9 hrs. 4 injections 1/133 2 injections 1/266 | Ether at delivery | Alb. 5 gm. N.P.N. 43 mg. | Living | Death two hours after delivery | None | Acute tubular nephritis. Liver focal necrosis, peripheral subendocordial hemorrhage. No uterine injury |

TABLE I—CONT'D.

| NO. | AGE | DATE OF ADMISSION | DATE OF DELIVERY | DURATION OF PREGNANCY | GRAVIDA | DIAGNOSIS | DURATION OF LABOR | CHARACTER OF DELIVERY |
|---|---|---|---|---|---|---|---|---|
| 9 | 24 | Oct. 29, 1920. | Oct. 29, 1920. | 32 weeks | I. | Eclampsia | 7¾ hrs. | Manual and Bossi Dilatation. Midforceps |
| 10 | 21 | May 13, 1923. | May 13, 1923. | 36 weeks | I. | Eclampsia | 21 hrs. | Induction Voorhees bag. Low forceps |
| 11 | 40 | Mar. 29, 1923. | Mar. 31, 1923. | 37 weeks | XIII. | Hydramnois over 10,000 c.c. | 1¾ hrs. | Spontaneous |
| 12 | 31 | May 14, 1923. | May 16, 1923. | 37 weeks | IX. — | Twin Pregnancy McDonald 44 | 7 hrs. | Induction Voorhees Bag. Pressure symptoms. Version. Twins |
| 13 | 21 | Oct. 22, 1922. | Oct. 23, 1922. | 36 weeks | II. | Chronic Interstitial Nephritis | 3½ hrs. | Spontaneous |

after the delivery of twins in which no veratrum viride had been used, with a prompt rise in blood pressure following. In his paper Bailey came to the following conclusions:

1. Rapid emptying of the uterus in eclampsia frequently produces a decrease in blood pressure amounting to 100 mm. Hg., causing a condition of collapse or shock.

2. Veratrum viride given to its full physiologic effect may cause a drop of 145 mm. Hg. in the blood pressure, producing shock.

3. The administration of veratrum viride combined with emptying of the uterus in eclampsia may produce such profound shock that the patient cannot recover.

4. While it is probable that the high blood pressure of eclampsia is one of Nature's protective mechanisms, still if it is deemed advisable to lower it, nitroglycerin and erythol tetranitrate should be used, for their action is on the peripheral vessels and not on the medullary centers.

5. One of the best means of temporarily lowering the blood pressure in antepartum or intrapartum eclampsia is the emptying of the uterus.

Further, MacGlannan in discussing blood pressure changes during abdominal operations, points out that during cesarean section there was no marked drop in blood pressure; whereas, if the section was

TABLE I—CONT'D.

| SCOPOLAMINE MORPHINE | ANESTHESIA | ALBUMIN N.P.N. | CONDITION OF CHILD | CONDITION OF MOTHER | HEMORRHAGE | AUTOPSY FINDINGS |
|---|---|---|---|---|---|---|
| 5 injections over 7 hrs. 3 injections Gr. 1/133 2 injections Gr. 1/200 | Ether at delivery | Alb. ++++ Hyaline Granular casts | Stillborn | Recovery | None | |
| None | Nitrous oxide at delivery | | Living | Recovery | None | |
| None | None | Albumin trace | Living | Recovery | None | |
| None | $ChCl_3$ at delivery | No albumin | Twins Living Wt. 2410 " 2910 | Recovery | None | |
| None | Nitrous oxide at delivery | Alb. 1½ gm. per lit. Hyaline finely and coarsely granular N.P.N. 29.4 mg. | Living | Recovery | None | |

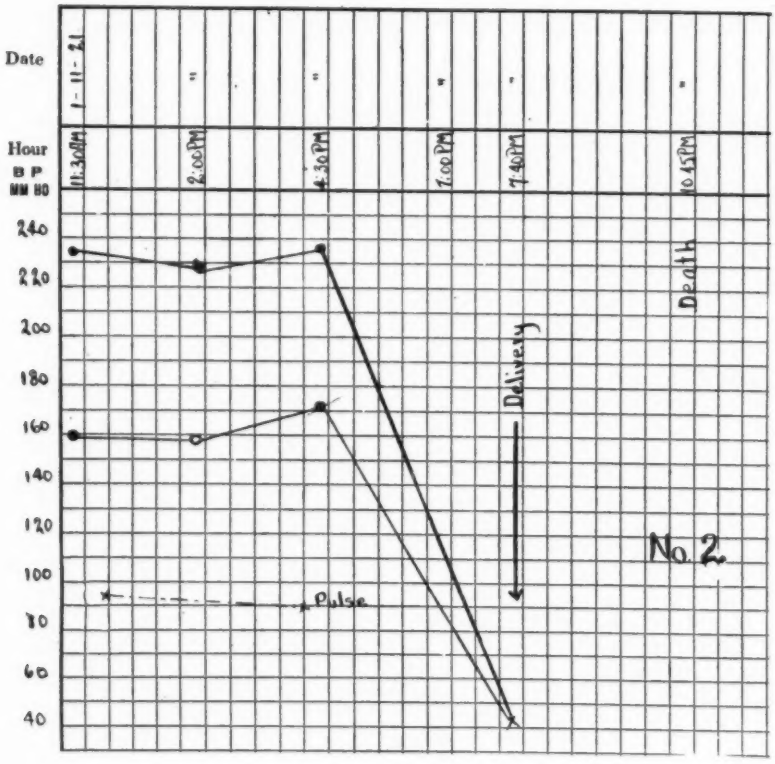
done in a case of eclampsia the fall in pressure, as the uterus was emptied, was a great one, and illustrates this in a case which dropped from 160 to 70 over a period of forty minutes.

In the cases that we have observed with marked drop in blood pressure following delivery, we have been impressed with the fact that these occur in some cases almost immediately after delivery. Mindful of this fact, we thought it would be of interest to study in this connection a series of more or less normal cases. Accordingly, eighty cases were studied, and it was noticed that during labor in many instances there is a rise in blood pressure toward the end amounting to 10 to 20 mm. Hg., and occasionally somewhat higher. A slight drop of 10 to 20 mm. Hg., usually follows in the first ten minutes after delivery. In cases in which there was slight hypertension (140-150) the drop was somewhat greater, not infrequently as much as 40 mm. Hg., but with no unusual symptoms and a prompt rise following.

These observations coincided with the observations of Bailey and others in normal cases. In two occasions there were drops of over 50 mm. Hg., but in one case there was a slight postpartum hemorrhage and the other also followed a hemorrhage associated with the manual removal of a retained placenta an hour and a half after delivery. It may be stated that in this series perhaps half of the patients re-

ceived scopolamine, and at the beginning of the third stage they received 1 c.c. of pituitrin, and also 1 c.c. of ernutin at the end of the third stage.

Two cases recently observed are of particular interest. One was a case of hydramnios in which there was over 10,000 c.c. of amniotic fluid, with the patient abnormally distended, and which showed a comparatively small drop after delivery and no evidence of either syncope or shock. Another case, just delivered showed a markedly distended uterus from a double ovum twin pregnancy. Both fetuses were fairly large, 2410

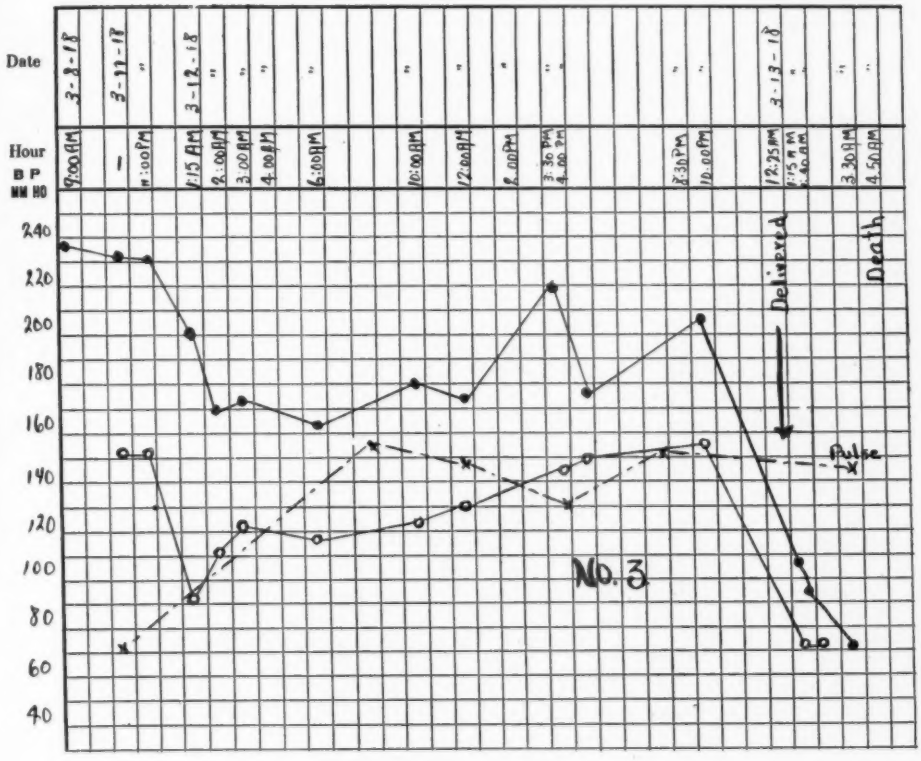



and 2910 gm. respectively, with a slight hydramnios in one amniotic cavity. This case showed practically no drop following the delivery of either child, and only a slight one after the expulsion of the placenta. These cases serve to demonstrate that factors other than the sudden emptying of the overdistended uterus are necessary and, perhaps, even more important.

It appears from my experience that the multiparous patients who have a chronic nephritic process ordinarily, and who develop an exacerbation of this condition during pregnancy, are most apt to show the largest drops; although so-called preeclamptic and eclamptic

primiparous patients show the drop quite as well. As previously mentioned, in some instances this fall has been observed to occur as early as two minutes following delivery to its fullest extent, while in others it has occurred to its fullest extent sometimes as late as two hours after delivery. These drops are frequently as great as 100 mm. Hg., and if the pressure does not rise in a comparatively short period of time the condition is serious and may even lead to death.

That the condition is best described as a syncope immediately after delivery is, perhaps, the most logical. In some instances if proper measures are instituted the patient immediately recovers. In other

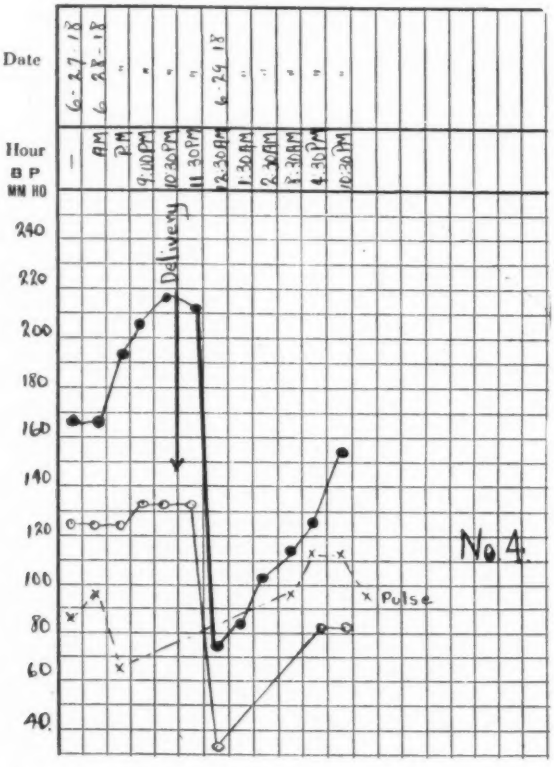



instances this syncope may lead to a condition analagous to shock, and the response to stimulation become less effective; further, the patient, if neglected, may go into definite shock and death may follow it in spite of all stimulation.

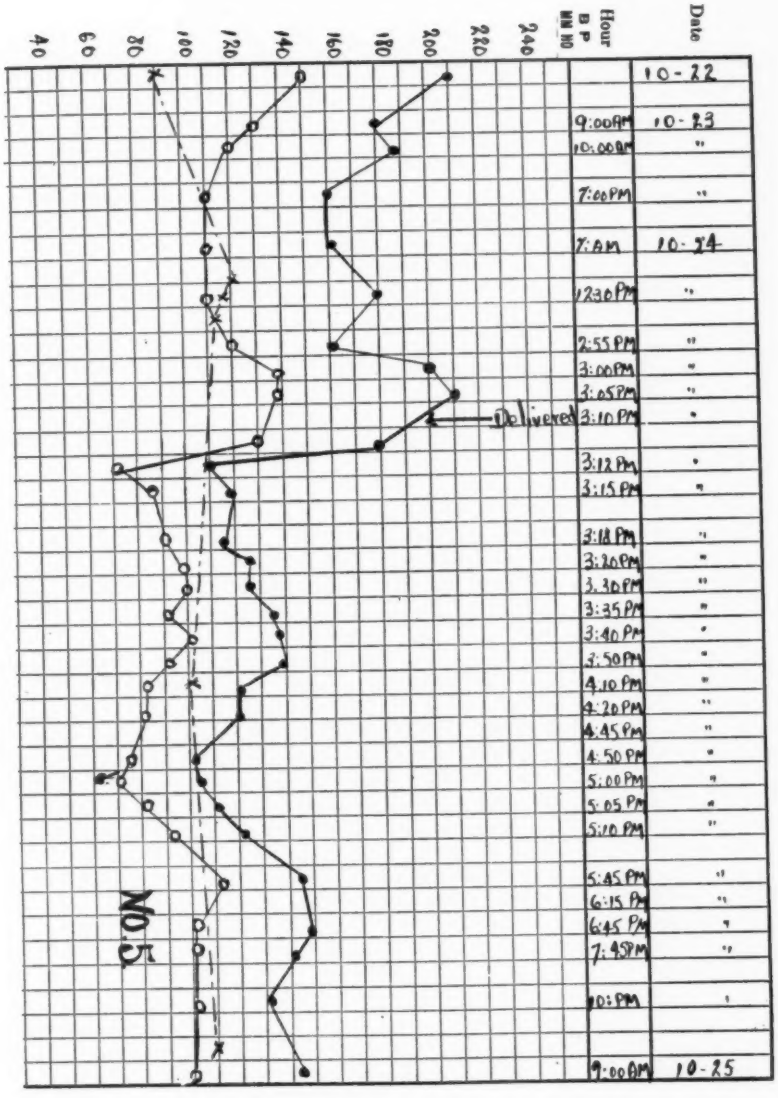
The question as to what these drops are actually due is perhaps not so easy to explain. Judging from the study of the normal series, and even in cases of great distention of the abdominal wall, if these cases are properly handled in the absence of hemorrhage, there seems to be present a mechanism which prevents a dilatation of the splanchnic

area in spite of the sudden change in abdominal pressure and the marked laxity of the abdominal wall.

The old experiments of Leonard Hill may be properly mentioned at this point. These concern so-called gravity shock. They are described by Macleod in the following manner: Gravity shock is caused by the stagnation of blood in the splanchnic vessels and a consequent inadequate filling of the heart in diastole. It occurs, when the erect position is assumed, in animals in which the mechanism, which ordinarily compensates for the tendency of gravity to make the blood flow to the dependent parts, is inadequate. Thus, when a domesticated rabbit with a large pendulous abdomen is held in the




vertical tail down position for any length of time, the animal gradually passes into a shocked condition and may die in a short time (20 to 30 min.). Observation of the blood vessels of the ear or a record of arterial blood pressure will show that the cause of shock in this case has been a great curtailment of the blood supply to the upper part of the body, and therefore to the nerve centers. The shock is entirely dependent upon the laxity of the abdominal musculature, for if a binder is applied to the abdomen, or if the experiment is performed on a rabbit whose abdominal musculature is in good condition, gravity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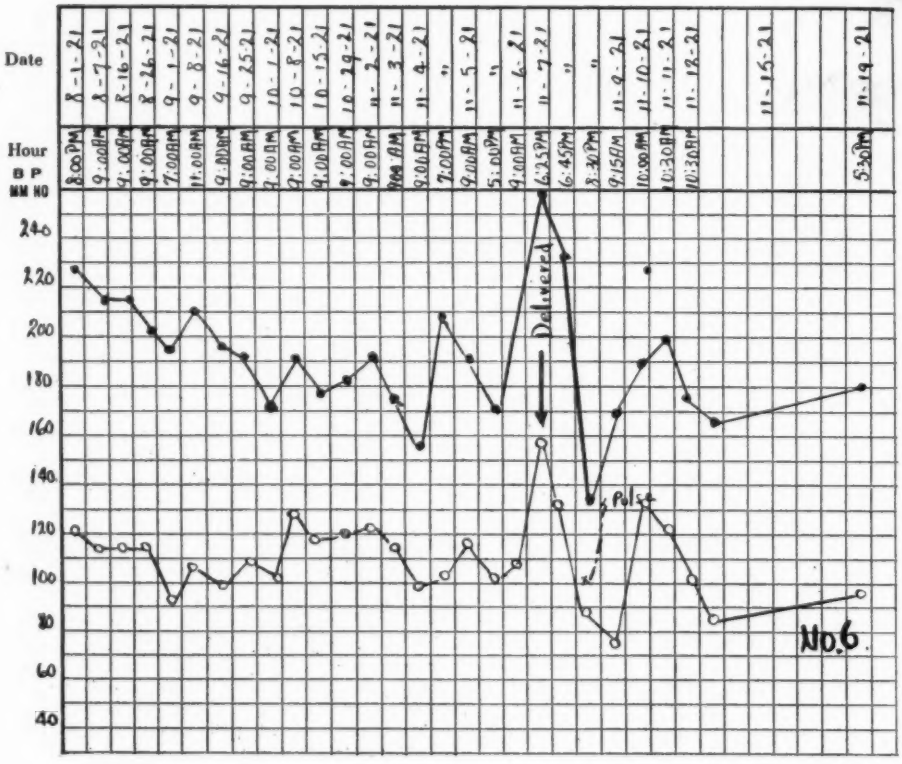
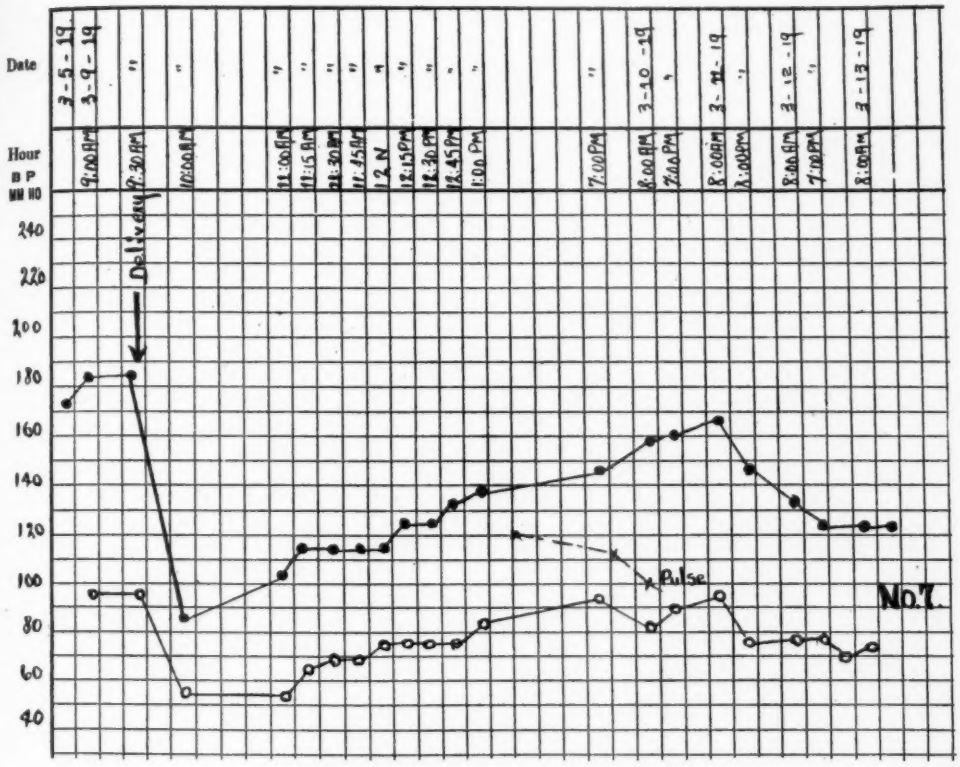
shock does not develop. Nor can fatal shock be produced in a dog, although in a deeply anesthetized animal a marked fall in arterial blood pressure occurs when the vertical tail down position is assumed. In man, in whom compensation for the erect posture is highly developed, shock from gravity occurs only when there has been some other considerable upset in the circulatory mechanism.

As previously mentioned, in cases of normal pregnancy the vasomotor mechanism is sufficient to take care of the sudden emptying of the uterus and the relaxation of the abdominal wall. In cases of toxemia, however, due to an already strained vasomotor mechanism,




perhaps chiefly influenced by the presence of toxic substances, compensation does not take place and there results a great splanchnic dilatation with insufficient amount of filling of the heart during diastole. If this condition is not anticipated and efforts made immediately to combat it, a more permanent condition develops which is more resistant to stimulation.

Although in normal cases the physiologic hemorrhage of the third stage, the delivery, either spontaneous or operative, the anesthesia and the rapid emptying of the uterus with the relaxed abdominal wall are attended with no unusual symptoms, these factors in markedly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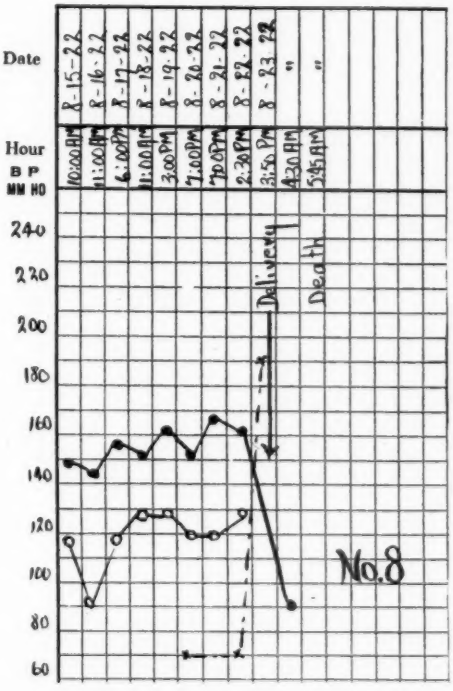
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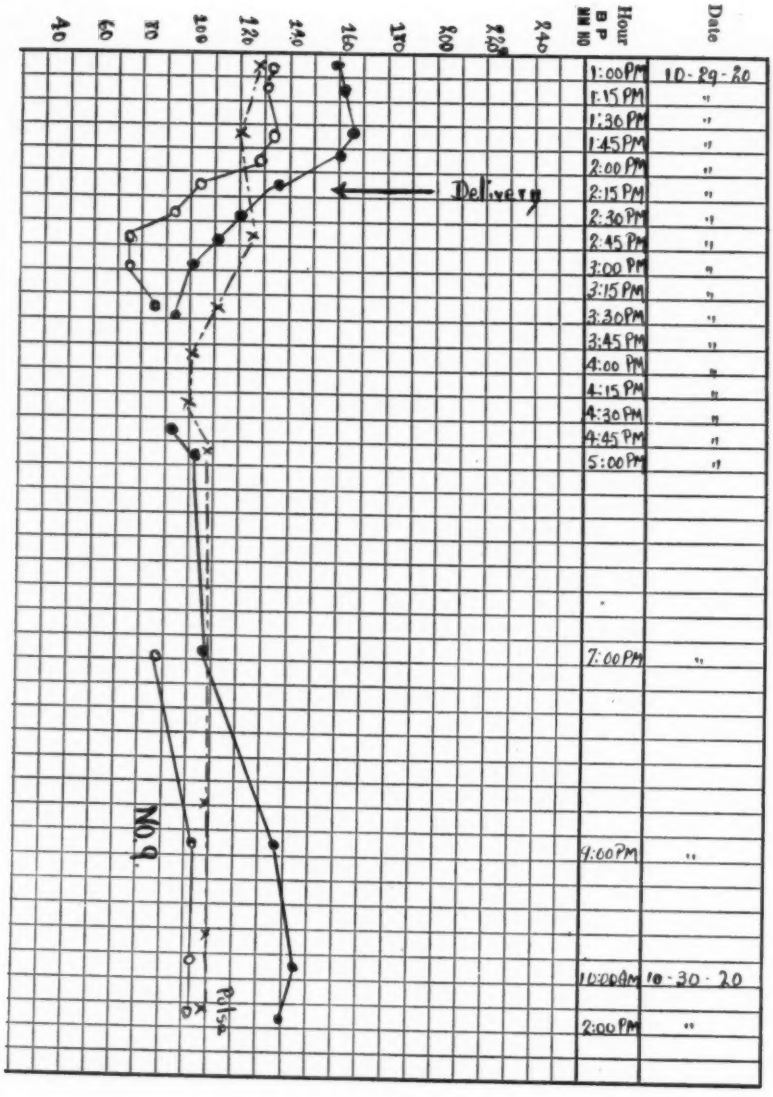
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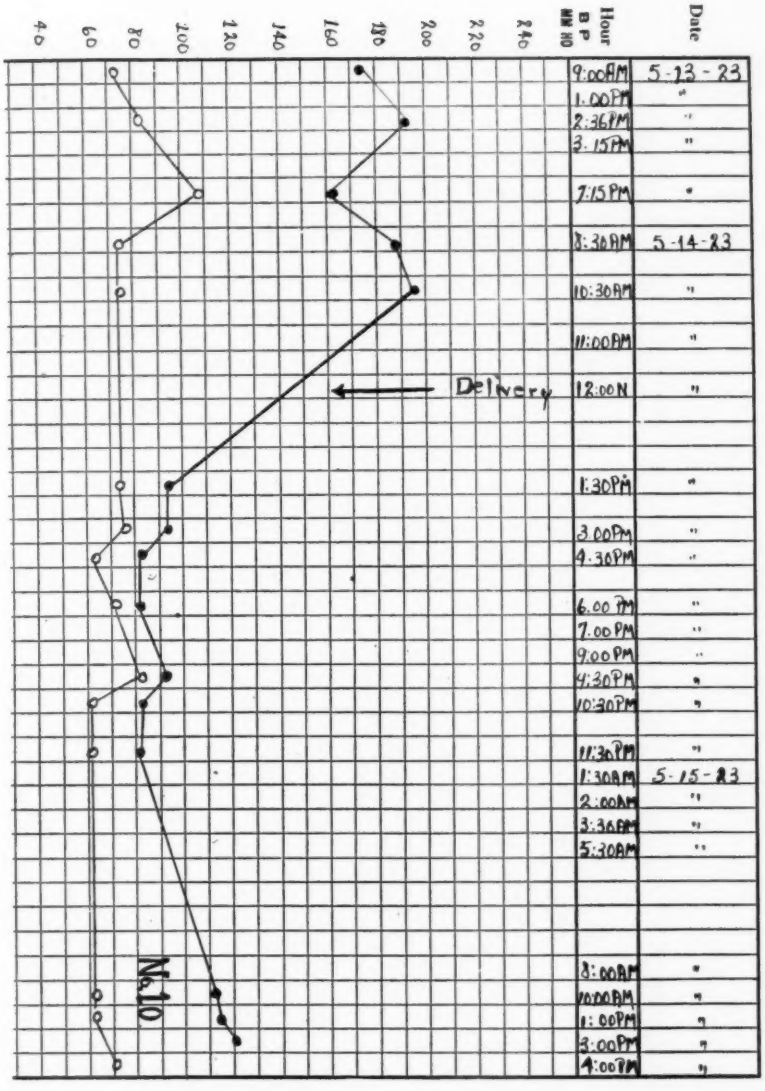
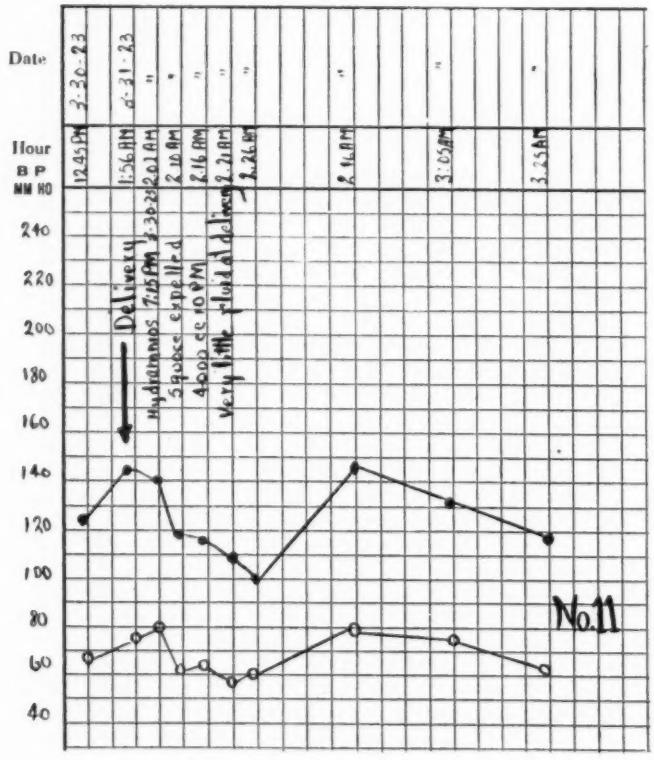
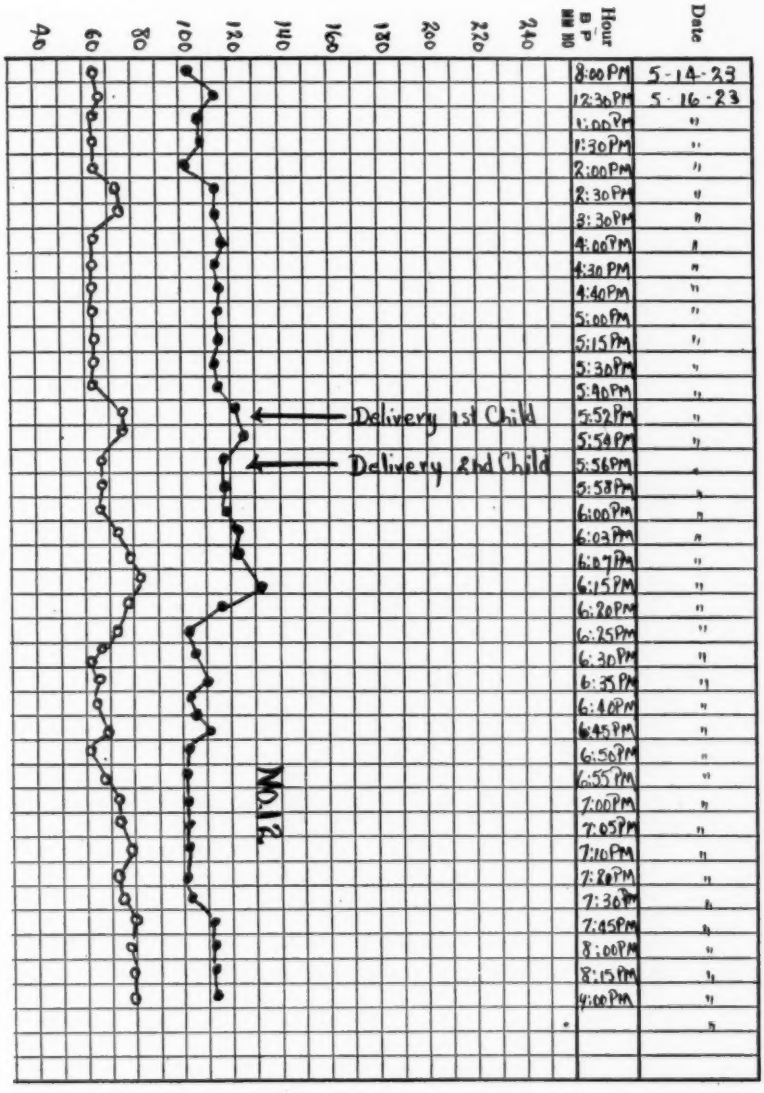


toxic cases may act in an accumulative way to bring out this condition, which may be termed shock.

It will be noted that the cases included in this series received comparatively little drugging before delivery. No chloral or veratrum viride was used. Scopolamine was used rather freely in three or four cases, but can hardly be accounted responsible for these drops except as part of an accumulation of causes, particularly since there was no difference in the normal cases, whether scopolamine was or was not used. Magnesium sulphate was used in one case by Dr. Dorsett.




Whatever the actual cause or causes of this rather sudden drop with the varying symptoms may be, it is a condition which should be anticipated as possible after every delivery in cases of severe toxemia. In attending these patients efforts should be made to conserve the patient's strength throughout the period before delivery and at the time of delivery; saline solution subcutaneously, bowel and gastric lavage, should be the chief treatment. Drugs should be used cautiously and only in an accessory way. Veratrum viride should be avoided. If the patient is not in labor, induction should be carried out in a conservative way, with a spontaneous or easy operative delivery following. Immediately following delivery the application of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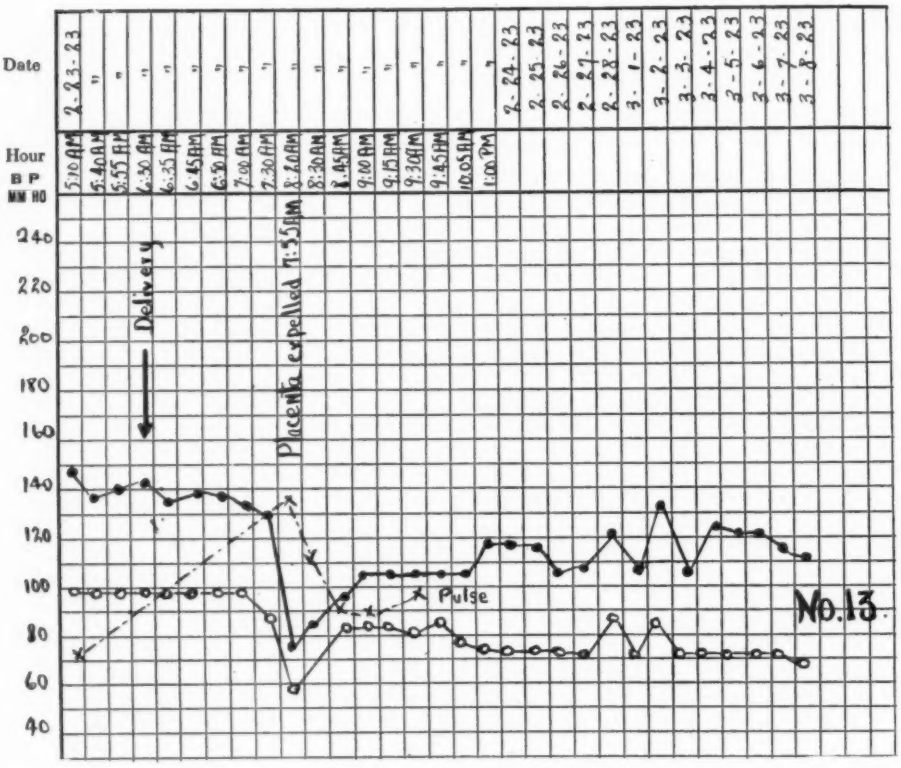
a tight binder and the placing of sand bags on the abdomen are perhaps the most important; the use of adrenalin, 15 mm., one injection, followed by pituitary extract is to be recommended. Intravenous glucose, possibly transfusion, should not be delayed, and other measures usually employed in shock should, of course, be included.

We agree with Bailey that the treatment of the toxemia is more important than the lowering of the blood pressure, and that the use of veratrum viride before delivery is particularly dangerous, and that the withdrawal of blood is also contraindicated. The fact that the




success of the treatment of eclampsia by the Dublin method stands out so prominently may be due to the fact that they treat the toxemia, and give little or no attention to the lowering of the blood pressure by the use of drugs or venesection.

The condition can be, perhaps, best studied by referring to the accompanying table and charts, and therefore I have omitted additional case histories.

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WASHINGTON UNIVERSITY.

# CARCINOMA OF BARTHOLIN'S GLAND*

By Frederick H. Falls, M.D., Iowa City, Iowa

PRIMARY carcinoma of Bartholin's gland is a very rare tumor. A review of the literature reveals not more than twenty cases. August Martin[1] in his book mentions the disease, and cites a case in which the diagnosis was made and recurrence followed removal in four years. In 1887 Geist[2] reported a case which he describes as part tubular cancer and part scirrhus. Schweizer[3] and Mackenrodt[4] both reported cases in 1893, but failed to give details regarding metastases, type of tumor and final result. These observations were followed by occasional contributions to the subject, most important of which are articles by O. V. Frisch[5] in 1904 and Sitzenfrey[6] in 1906. Spencer[7] in 1913 reviewed the literature and found seventeen cases. He also reported an additional case. In America, Kelly[8] described one case in 1898, Lynch[9] mentions a case but does not describe it fully, and Taussig[10] has a doubtful case.

Etiologically the same theories that are advanced for carcinoma in general may be applied to carcinomata arising in this tissue. Chronic inflammation has been present in a considerable number of the reported cases. Indeed, because of the rarity of malignant changes and the frequency of inflammatory reaction here, tumors have frequently been misdiagnosed as abscesses, or have arisen from the gland following an abscess formation. Kelly's case was first incised under the impression that it was an abscess, and several other cases have had a similar history.

The average age of the patients here presented is 52.7 years, the youngest being 29 and the oldest 91 years. The tumors usually develop after the menopause, and this has been cited as a possible cause of the tumor. There was no history of direct trauma in these cases.

Heredity has not been noted in many of the reported cases. Kelly states that the mother of his patient had carcinoma, and our case gave a history of a maternal and paternal uncle having died of carcinoma. The incidence of the various etiologic factors is not easily obtained from a study of the literature, because many of the reports have been extremely fragmentary even in the essential items.

A better understanding of the pathology of this condition can be obtained by a brief review of the histology of the gland. It is a compound acinous gland, the acini being lined by calciform columnar epithelium, and separated from each other by strands of connective

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tissue and striped muscle fibers (de Sinety[11]). The ducts on the other hand, are lined by columnar epithelium in the deeper parts which gradually gives way to two or more layers of transitional cells, and they in turn are replaced by squamous cells as the ducts approach the surface of the vulva. Jambon and Chaboux[12] state that "the excretory ducts appear in the middle of the gland in the form of irregular cavities reaching even to the middle of the acini. They present an epithelium either of one or of several layers of cuboidal cells. The lining becomes thicker as the ducts become larger and more important. The cells are only half the size of the secretory cells of the acini. Near the termination of the duct the superficial layers of the lining membrane tend to become squamous." These authors say nothing about a distinctly cylindrical epithelium of the ducts although it is mentioned by de Sinety, Klein,[13] Langhans[14] and J. Thomas.[15]

Sitzenfrey,[6] G. Nobles and others have called attention to the fact that, in chronic inflammation of the gland of neisserian origin, the ducts may be lined throughout their entire length by squamous cells instead of the transitional and columnar cells usually found in the deeper portions.

It will be seen, therefore, that there is a possibility of the development of two types of carcinoma in Bartholin's gland: (1) squamous cell tumors, arising from the ducts near the surface in uninflamed glands or in the deeper portions of the ducts in glands which have been the seat of chronic inflammation leading to alteration in their lining membranes; (2) the columnar cell carcinoma, or adenocarcinoma, arising from the gland acini or from the unaltered duct epithelium in their deeper portions. It is possible that carcinoma arising from the columnar cell elements of the gland may, as the tumor develops, come to resemble a squamous cell carcinoma, a phenomenon comparable to that which occurs in the adenocarcinoma of the cervix uteri.

Metastases frequently occur in the inguinal lymphatic glands of the same as well as the opposite side from which the tumor arose. The case described by Lynch died following the development of cerebral metastases. As in all carcinomata of the vulva, recurrence following removal is extremely common. In some patients the periosteum of the rami of the pubes is involved, and, as in our case, the urethra was involved at least in the periglandular inflammatory reaction. Sinus formation is common, and may persist for years before evidence of malignancy is seen. Ulceration of the skin overlying the tumor is very common, as is round cell infiltration of the supporting stroma of the gland.

There is no reported instance of bilateral carcinoma of the gland, although in Sitzenfrey's case there was a chronic inflammation of one of

Bartholin's glands, and carcinoma of the opposite gland at the same time.

The symptoms are swelling of the labium in the region of the gland with an edema of the remnants of the hymen on that side. In many cases this swelling was painless at first, followed in a few months as a rule by tenderness, and an aching drawing sensation. Sometimes there is a severe lancinating pain, which radiates to the coccyx and groin. It is aggravated by walking, or coitus, and is usually worse during the menstrual periods. Local examination reveals the growth as a hard lump, varying in size from a hickory nut to an orange which may be freely movable, or, in the later stages, attached to the surrounding structures and fixed. The skin over the tumor may be thin and bluish, and tends to ulcerate. The mass is frequently tender to touch, and may break down in the center forming a fluctuating mass before ulceration on the surface. The inguinal glands are early invaded, but in some cases their enlargement may be due to secondary infection following ulceration and necrosis of the primary tumor.

The course is usually rapidly downward. The reported cases are very deficient in data regarding the final outcome. Trotta[16] is the only man who reports a six year cure. Eden[17] reports a three year recovery. Many writers content themselves with the notation, "no recurrence in two to six months."

The diagnosis is usually easy when the possibility of the condition is kept in mind, but its extreme rarity has resulted in very few cases being diagnosed before operation. The chief diagnostic points are the age of incidence, usually over fifty, the hardness of the tumor and its tendency to fixation. Pain is very suggestive especially if associated with edema of the vulva and skin over the gland. Metastases to the regional lymph nodes, hard and shotty, and a tendency for the tumor to break down are the important points. The chronicity of the affection, and its failure to respond to ordinary therapeutic measures are also of value. Biopsy in doubtful cases establishes the diagnosis.

It must be differentiated from other carcinomata of the vulva such as epitheliomata arising from the labia or clitoris, and this may be very difficult in cases that have ulcerated when first seen. The history of the point of origin together with the fact that these are purely squamous cell carcinomata which do not involve the ducts is usually sufficient for differentiation. Abscess of Bartholin's gland has frequently been confused with carcinomata. The history of gonorrhea, with positive smears, and involvement of other structures, the acute course and the rapid response to surgical treatment usually make the diagnosis plain. Sarcoma of the gland or labium is a very rare tumor, occurring in younger individuals as a rule, and microscopic section reveals the characteristic mesoblastic cell. Melanotic tumors of this

region are not so very common, and their diagnosis is usually made on the rapid growth and the characteristic pigment production. Fibromata of the vulva are easily excluded by their very slow growth, good encapsulation, and failure to invade surrounding tissue.

The treatment consists in removal as soon as diagnosed, supplemented by radium application and x-ray treatments of the affected area, as well as the opposite side and inguinal region. Excision in early cases is usually easy, but in neglected cases when the pubic arch is involved as well as the vaginal wall a rather extensive dissection has to be carried out. Taussig advises a two step operation in which the regional lymphatics are first removed, using the Bassett technic, which includes the removal of the internal iliac glands, inguinal lymphatics, round ligament and the lymphatics under Poupart's ligament and in Scarpa's triangle. The same procedure is carried out on the opposite side. Two weeks later the tumor is removed by the cautery knife and the wound thus produced allowed to heal by granulation, treated by the open air method and Dakin's solution.

We have used local applications of radium and x-ray in the manner to be described in the following case.

The tumor occurred in a patient aged thirty-eight who applied for treatment on Feb. 15, 1922. She was an American, white, divorced for seven years, occupation housework; she had had two miscarriages, first at six months in 1914, with uneventful recovery; her menses began at seventeen, were regular, no dysmenorrhea, moderate in amount and lasted three to four days; her last period was Feb. 1, 1922. She denied nycturia, frequency, smarting or burning for the past two years; she had had no operations. The present illness began after the patient had been married a few days. Her husband had been a saloon keeper and considerable of a roué. She noted some discharge and pain and burning on urination. Her husband twice caused her to abort by kicking her in the abdomen and beating her. She is under the impression that during one of these attacks she was injured in the region of the left labia. About two years ago the patient first noticed some swelling of the left labia which gradually grew to the size of a large orange. She denied discharge from this swelling and stated that she could manipulate it and walk without pain. In October, 1921, she consulted a doctor who gave her potassium iodide for the tumor. The mass persisted and so she consulted another doctor who gave her some salve to apply. A few days later the tumor began to discharge a watery pus and decreased somewhat in size. For the previous months before entering the clinic she had no discharge and the tumor on entry was the size of a lemon and gave her very little pain or discomfort. There was nothing of importance in her past medical history. The family history showed her father and mother to be alive and well at the age of sixty-two; she had three brothers and two sisters alive and well; the grandparents had no history of carcinoma. One maternal and one paternal uncle had carcinoma.

*Physical examination:* Patient was a well developed, well nourished, white female; teeth in poor condition; no enlarged cervical glands; breasts were negative; lungs clear throughout on percussion and auscultation; vocal and tactile fremitus normal; heart well within normal limits; no thrills, shocks or murmurs. The abdomen showed no definite localized areas of tenderness; solid organs not palpable; no visible or palpable tumor masses. Vaginal examination revealed a slight amount

of greenish pus between the labia; no cutaneous irritation. The left labium majus bulged over the introitus, due to a mass the size of a lemon which seemed to arise in the region of Bartholin's gland. It was hard, fluctuated slightly, rather movable and was smooth everywhere except on its vaginal aspect, where it was rough and nodular like a carcinoma. This roughened area presented numerous small white ulcers varying in size from 5 to 25 mm. which bled quite readily. The entire mass was very tender and the skin over it was somewhat bluish and edematous. The right labium was negative. Pus could be expressed from the urethra. Smears from the same were negative for gonococci. The cervix was small and conical; uterus freely movable and in good position; adnexa were not palpable. The left chain of inguinal glands were enlarged and hard, the largest being the size of a

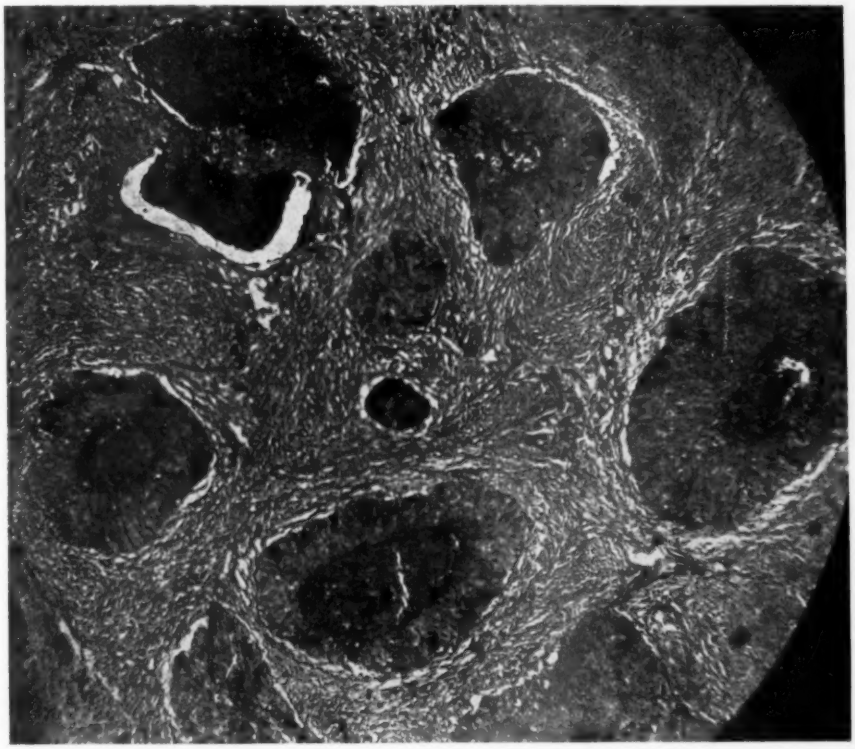

Fig. 1.—Carcinomatous degeneration of the epithelium of the ducts of the gland giving rise to squamous cell carcinomatous infiltration.

hickory nut. The blood count: Hb. 95 per cent; RBC 4,620,000; WBC 11,000; Blood pressure 135/80. Wassermann 4+ to both antigens.

The preoperative diagnosis of chronic granuloma, possible carcinoma, was made. Operation was performed on March 3, 1922. The tumor was found to be adherent to the levator ani in its lower pole, and to extend to the ramus of the pubis laterally. The dissection was carried as wide as possible, and a small piece of the urethra was accidentally removed with the upper pole. Recovery was uneventful, and the pathologic report is here given.

*Gross description:* The specimen is an oval mass of 6×3×3 cms. The surface is irregular in outline and slightly hemorrhagic. It is firm in consistency. The cut surface is light in color, moist, and granular, with no evidence of necrosis. On

scraping across the cut surface a fluid containing small granules resembling cancer juice is seen.

*Microscopic description:* Section of the tissue shows a rapidly growing carcinoma invading the entire depth of the tissue received. The carcinoma tends to be medullary in type and in places appears to be growing in the lymphatics. The tumor tissue shows considerable tendency to grow as pseudostratified epithelium, with occasional epithelial pearls. In places it appears very much like epithelium lining ducts. It probably arose from duct epithelium. In another region adenocarcinoma cells can be seen forming a typical acini as they invade the gland stroma.

*Diagnosis:* Carcinoma of Bartholin's gland.

Immediately upon determination of the malignancy of the tumor we placed 25 mg. of radium into the wound and 25 mg. over the left inguinal region, making a

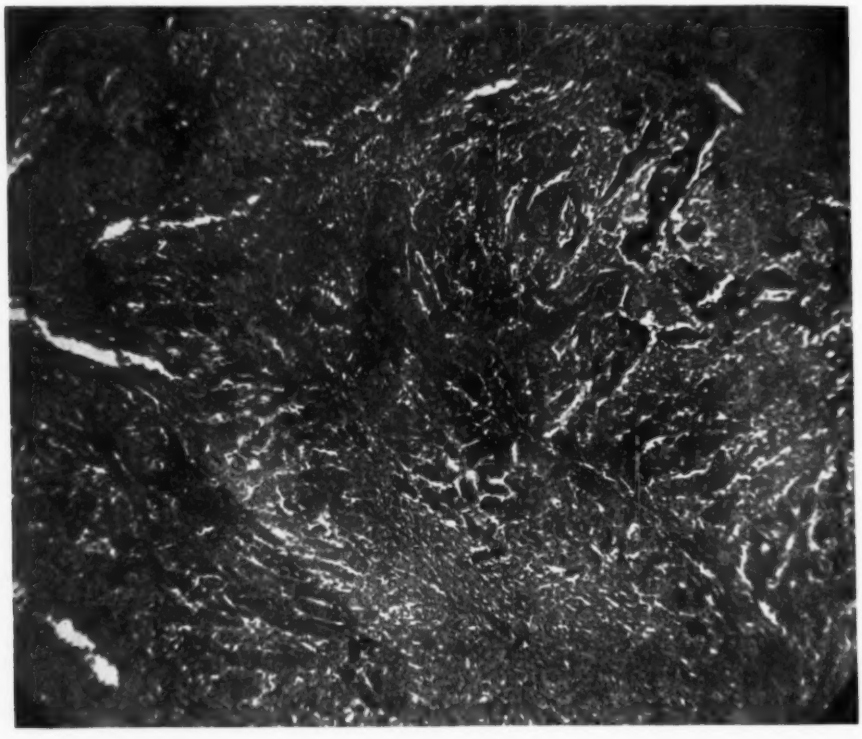

**Fig. 2.—Carcinomatous degeneration of the epithelium of the acini of the gland giving rise to adenocarcinomatous infiltration.**

total application of 625 mghr. One week later we repeated the application, this time using 750 mghr. or a total of 1375 mghr. for both treatments. This was followed by 10 x-ray treatments. The wound healed nicely and the patient was discharged on March 29, 1922, after having had salvarsan and grey oil injections.

She returned on May 2, 1922, with a history that there had been considerable reaction at the site of application of the radium, which, however, had disappeared at this time. Because of this history of reaction she was given only 250 mghr. of radium over the left inguinal region and no x-ray treatments. She also received further antiluetic treatment and was discharged on the 27th. There was no evidence of recurrence, either local or metastatic at this time.

She reentered the hospital July 27th and stated that since she left the hospital

TABLE I

| AUTHOR AND CASE | AGE | INFLAMMATION | OPERATION | TYPE | METASTASIS | RESULT |
|---|---|---|---|---|---|---|
| 1. Kelly | 55 | None | Incised. 4 months later excised. | Adeno-Carcinoma | | |
| 2. Eden | 40 | Abscess with Sinus | Removal with inguinal glands and part of pubic arch, radium | Adeno-Carcinoma | Inguinal glands | No recurrence in three years. |
| 3. Spencer | 43 | | Excision with both inguinal chains. | Adeno-Carcinoma | None | No recurrence in 22 months. |
| 4. Lynch | 43 | None | Removal with inguinal and vaginal metastases | Squamous | Right inguinal and cerebral | Death 2½ years later. |
| 5. Martin | 70 | None | Removal with inguinal glands | | Inguinal glands | Recurrence in 4 years |
| 6. Geist | 59 | None | Removal | Adeno-Carcinoma | None | |
| 7. Schweitzer | 58 | Diagnosed inflammatory 3 years. | Refused | Carcinoma parvi cellular | None | |
| 8. Mackenrodt | 54 | None | Removal | | None | No recurrence in four months. |
| 9. Honan[19] | 40 | Discharging sinus 1 year. | Removal | | Opposite inguinals I year later | No recurrence in two months. |
| 10. Godart[20] | 45 | None | | | | |
| 11. Trotta | 30 | None | Removal | Chancroid Carcinoma | None | No recurrence in six years. |
| 12. R. Schaffer[21] | 73 | Considered abscess 4 years. | Removal | Adeno-Carcinoma | Inguinal glands | Recurrence in two years |
| 13. Burghele[22] | 50 | Fistulae | | Adeno-Carcinoma | | Recurrence in 1 month. 2nd removal. |
| 14. O. V. Frisch | 77 | Discharging siuns | Removal—local anesthetic | Adeno-Carcinoma | Inguinal | |
| 15. A. Sitzenfrey | 29 | Bilateral inflammation of gland | Removal—Thermocautery | Adeno-Carcinoma | None | Recurrence in scar 6 months. 2nd removal. |
| 16. Pape[23] | 91 | None | Removal | Adeno-Carcinoma | None | |
| 17. Falls | 39 | Ge and Lues | Removal left inguinals, radium | Adeno-Carcinoma | None | No recurrence in 14 months. |

she had had no discharge, pain or tenderness and was in the best of health. She had been up and around working all of the time; there had been no bladder or rectal disturbances. The only change noted was that she had not menstruated since April, had hot flashes and other symptoms of an early menopause. The physical examination was absolutely negative as far as recurrence in the labium was concerned and the inguinal glands were not larger than normal. The blood examination at this time revealed RBC 4,295,000; WBC 8,700; Hg 83 per cent and normal differential count. At this time, as a prophylactic measure, an extensive dissection of the inguinal glands was made, and the lymphatics of the upper portion of the left labium and the round ligament were also removed. Nothing resembling carcinoma was seen at this time and the wound healed by first intention.

She reentered the hospital on Nov. 1, 1922, for continuation of her antiluetic treatment and for a radium burn in the left inguinal region about the size of a dollar. This burn healed slowly under treatment by moist dressings followed by balsam of Peru. There was no evidence of metastases at this time and her general condition was very good.

It has now been approximately fourteen months since the operation and there is no evidence of recurrence. We, of course, realize that it is too early to speak of cure in this connection.

The rarity of this tumor together with the paucity of literature, especially American, on this subject has prompted the writer to present this subject before this society.

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(*For discussion see p.* 749.)

# PYELITIS OF PREGNANCY*

By Norris W. Vaux, M.D., Philadelphia, Pa.

IN reviewing the literature before approaching this important complication of pregnancy it would seem that great stress has been laid by investigators upon finding a specific factor upon which might be placed the entire blame for its causation. But not all those whose enthusiasm has led them in their investigation and research have fully taken into consideration the kidneys and their important rôle during gestation and pregnancy itself. The former can well be considered as first, for notwithstanding the many changes that occur in pregnant women's organs and tissue, most of the investigators have relied solely in their research upon the kidney tract and its function, unassociated with the other organs and tissue, to bring out a positive proof, failing entirely to associate the anatomic changes that occur in other organs of the individual during pregnancy. It is upon the kidney that falls one, if not the most important, rôle during the many months preceding and following childbirth. If we consider the pregnant individual's systems separately, setting aside the particular organs of gestation temporarily, the order in which the health of the individual depends we can readily place as follows: the digestive tract and organs associated with the same, and the urinary system, including the kidneys, ureters and bladder. These with the vascular system are, without doubt, the three leading systems in the order named, playing their major parts and each dependent upon the other in true accord and balance. Each can and will produce at times distinct and serious complications which in turn involve the other two. But of the three, the urinary system, if pathologic changes begin, leads to the gravest and most serious complications for both the individual and offspring during the antenatal and postnatal states. It might be well to consider that pyelitis in nonpregnant women is comparatively infrequent as a complication or sequel following other febrile disease, while in pregnancy, on the other hand, it is by no means an infrequent complication.

The study of this condition complicating pregnancy was begun with a very definite point of view, namely, that a distinct and separate cause or associated causes in each instance could be located by means of a thorough routine procedure. All patients underwent the same course of study, developed the disease between the third and eighth month of gestation and were cared for in institutions where every facility was available for a thorough clinical and laboratory investigation.

*Read by invitation at the Forty-eighth Annual Meeting of the American Gynecological Society, Hot Springs, Va., May 21-23, 1923.

It might be well to give a brief summary of the leading factors taken from the histories and physical examinations on admission, which points may possibly be factors leading up to or having some distinct part toward causing this complication. The constant chief complaints were pain in the right lumbar region with frequent urination, pyrexia, increase of pulse rate, malaise, headache, chilly sensation, with nausea and vomiting. Weakness and constipation were invariably included in these symptoms. The ages varied from eighteen to forty-one years, sixty per cent were primiparae and of the multiparae no history of pyelitis during their previous confinements was given. Two gave a positive history of kidney complication during an illness of childhood. Three gave a family history of tuberculosis, others mentioned the usual diseases of childhood and occasional colds to which no significance was definitely attached, and all denied venereal diseases.

Likewise it would be well to summarize the findings of the physical examinations: The patients were generally undernourished, of average stature and showed a varying degree of anemia. In three cases a definite benign hyperplasia of the thyroid gland was demonstrable with no other evidence of glandular involvement. In none was there any evidence of any specific disease and no marked physical defects in skeletal development or deformities. The tonsils had been removed in fifty per cent, the remainder showed no cryptic or associated tonsilar diseases. There were no increased reflexes, palsies or areas of integument anesthesia. The teeth were invariably poor and several cases showed definite gingivitis with pyorrhea. Three gave evidence of cardiac lesions with normal compensation, and no acute or chronic lesions were demonstrable in the lungs. Five had had previous abdominal operations, such as drainage for suppurating appendicitis, ruptured left tubal pregnancy, etc. One patient gave a history of previous pelvic inflammatory disease, where removal of one tube and ovary was necessary. This might be considered of etiologic importance in the production of pyelitis in that the peritoneal adhesions involved the course of the ureter at the vesical neck, thus distorting or pulling the normal structures into abnormal position. A previous pelvic examination was made to determine the position and condition of the rectum, pelvic floor, vaginal walls, cervix and body of uterus. In the cystoscopic findings a definite edema of the vesical portion of the ureter, and an associated protrusion into the bladder or prominence of the infected orificial area were present in all severe cases. In seven cases only was cystoscopic examination and ureteral catheterization performed. In each patient repeated phthalin estimations of the whole urine were made and showed a percentage of from forty-seven to sixty-one. This varied considerably from time to time in the same individual. Four cases showed a definite cystocele

and rectocele, two a marked rectocele with little or no anterior wall involvement. Six showed bilateral lacerations of the cervix with eversion of the mucosa and hypertrophy. In one case there was a small benign cervical polyp. Both multiparae and primiparae had a vaginal discharge, varying from moderate thin white discharge to a profuse mucopurulent leucorrhea. Wassermanns were negative with all antigens throughout. Bacterial study of the vaginal and cervical discharge from smears and cultures gave only one positive Neisserian infection; the others were generalized mixed infections of low virulence and poor culture growth. The symptoms given in the history usually began early and were allowed to continue untreated and undiagnosed until systemic symptoms occurred, showing a definite pathologic kidney involvement which brought them under observation and treatment.

It is not my intention here to go into detail on the pathologic change that exists in the kidney during this complication other than to call attention to the fact that, in every instance where the clinical findings were definitely manifested, as pain in the kidney region, fever, chills, leucocytosis and purulent urine, the pathologic change in the kidney substance was accepted as a pyelonephritis and proved, incompletely, later in pyelograms of the kidney pelvis, blood and urinary findings. I wish to emphasize the fact that there is a close association of all the systems that go to make up the human organism and that if any of these intricate and delicately balanced structures fails or hesitates in its function during the months of pregnancy, it can readily throw one or more of the others into associated pathologic confusion. If, in the general study of pregnant women, all the systems are not most carefully considered and studied, some dreaded complication occurs in one which involves another, and so varied and perplexing does the situation become that often we are at a loss in the avalanche of clinical and pathologic evidence to determine the primary offending member.

Many and varied are the theories and factors on which eminent clinicians and scientists have placed this responsibility and blame, such as ascending infection of the kidneys from the lower portion of the urinary tract, absorption or transmission of the infection from the intestinal canal, and infection by way of the blood stream. More especially must we look to the combination of normal anatomic and physiologic changes that occur during pregnancy to place this responsibility.

Early in pregnancy there is a definite congestion and hyperemia of all the pelvic organs which is shared by the bladder. As pregnancy progresses these changes become more marked. Later an anatomic change in the position of the uterus occurs with a decided tendency

to tilt towards the right. Along with the uterus, after the third month, the urinary bladder ceases to be a pelvic organ and assumes the rôle of an upper pelvic or lower abdominal organ. The trigone of the bladder moves upward, in some cases quite up to and back of the symphysis pubis, with the associate lengthening of the urethra and the upward turning of the vesical portion of the ureters. There is a definite softening and lengthening of the ligamentous attachments allowing, to a greater or lesser degree, the ascent of the bladder along with the uterus towards and often out of the true pelvis. This has been proved by findings during cystoscopic examination where a decided lengthening of the urethra was present and at cesarean sections when catheterization has been done immediately preceding operation, the high position of the bladder and its misplacement to the left was so forcibly brought to attention. It is undoubtedly true that the mechanical action of the gravid uterus at the fifth month exerts its full effect upon the sharp pelvic brim directly over the course of the ureter, and in this way may produce a partial or complete occlusion of one or both ureters, while later in pregnancy it assumes a more decided dropping or sagging forward away from the posterior lateral walls, at which time the pressure is consequently relieved at that point. A further point of etiologic importance in the production of pyelitis is bladder retention incident to pressure of the pregnant uterus on the vesical neck. Previous history of pyelitis of infancy or in subsequent illnesses must be looked upon as a possible forerunner of pyelitis of pregnancy.

A leading factor and an interesting condition which exists, as those who practice obstetrics are fully aware, is that from the early months onward the urinary bladder in pregnancy contains varying amounts of residual urine. A catheter into the bladder of almost any pregnant woman immediately following the normal voiding of urine will determine a residual equal to, or larger than, the amount just voided. This complication and the persistency of it in cases of pyelitis along with the urinary findings lead us to suppose that here may be found another of the attributing factors in the pyelitis of pregnancy. The symptom which causes the first annoyance to the patient generally is frequency of urination. The microscopic examination of the urine at this time shows no marked excess of leucocytes or bacteria. There is no evidence manifested of systemic involvement either in pulse, temperature or blood examination. The primary symptoms are associated in the bladder, in my experience, with a varying degree of residual urine and never at any time in this series of cases was it possible to procure in blood culture a growth that might lead to the positive proof of a blood stream infection.

In this series cystoscopic examination showed the right kidney to

be involved in each instance. Many times the early symptoms of pyelitis are so transient and unnoteworthy from the patient's point of view that they are entirely ignored. If such be the case the condition is allowed to continue until it is so evident that associated analysis and studies are of little or no value, other than to prove the seriousness and magnitude of damage done in the organs involved. The early frequency of urination, whether on the feet or in bed, is such a common complaint by the patient as to often be dismissed with little or no treatment to rectify this distressing and harassing condition. Obstinate constipation has been claimed as a frequent factor in the causation of pyelitis and undoubtedly must play a definite part.

The anemia which appears early in pregnancy is largely due to the associated nausea and vomiting in the early months and is very definitely a factor, as it lowers the nutrition and eventually the power to resist infection. The nausea and vomiting deprive the individual of the adequate supply of fluids, and this too may lessen the power of the kidney to resist infection.

The lessening of the normal bladder reflexes in these cases was forcibly brought into prominence. The reflex showed marked variation. In some there was constant tenesmus, in others frequent inclination, while in still others there was no desire to void, under which circumstances the patient found it necessary to urinate at regular intervals and was unable to satisfy herself that the bladder was completely empty without undue straining.

In this entire group as far as the bacterial findings of cultured, catheterized specimens of urine are concerned, the one common organism found was the colon bacillus, but one case showed streptococcus aureus. It can well be said that the colon bacillus is the common bacterium in pyelitis. Further, this was so in all specimens obtained from ureteral catheterizations.

The cystoscopic findings were of interest. A definite cystitis was present with a marked hyperemia of the mucosa, most marked about the base of the bladder and trigone, and occasional hyperemic and edematous areas scattered over the bladder wall, usually in the lower portion. The ureteral orifice of the side involved showed a definite redness and swelling. The orifice was virtually occluded by edema and the vesical portion quite distinctly protruded into the bladder. Small amounts of what seemed to be cloudy urine were dribbling rather than being forcibly ejected into the bladder cavity. In not every case was ureteral catheterization performed. No necrotic areas of the bladder wall or hemorrhagic areas or polypoid growths, ulcerations or calculi were present. Pyelograms were made in only three instances and were not considered highly satisfactory, but showed an irregular, not sharply defined kidney pelvis and indefinite kidney substance involvement with little if any hydronephrosis.

General health and complete examination of teeth, tonsils and outside sources of infection were carefully considered, and in one case only could a focus be found. X-ray examination showed apical alveolar abcess at the base of the second lower molar on the right side. Pain, occasionally severe, was definitely localized over the right lumbar region and kidney area with intermittent radiation to the right groin and suprapubic region. Only once in this series were both kidneys involved. The blood picture was the same throughout, namely leucocytosis with the polymorphonuclear cells predominating, a varying mild anemia and a negative blood culture. The remarkable coincidence was that in every instance where the blood was typed it was in type 4 group. There was no maternal mortality, all recovered under treatment and completed the full term of gestation except one, on whom labor was induced at the seventh month owing to the gravity of the toxemia present, and the double kidney infection which gave grave fear for maternal life.

Early symptoms of frequency and bacilluria must be considered important enough at the onset to demand treatment: Rest in bed (milk and water diet) in Fowler or semi-Fowler position, instructions to take knee chest position three times a day for five minutes. Patients were requested not to sleep on the right side habitually. Immediate attention was given to free catharsis, sufficient to move the bowels thoroughly, yet not enough to dehydrate the tissues, or cause purgation sufficient to threaten interruption of pregnancy. Vaccine and intravenous medication, both of which were given a sufficient trial, proved to be of no benefit in checking the infection; they were annoying to the patient and caused excessive reaction without any material symptomatic benefit being derived from their administration. Irrigation of the kidney pelvis by ureteral catheterization did not prove curative even though the catheter was left in situ thirty-six hours with frequent flushings of the kidney pelvis. Both mild antiseptic and normal saline solution seemed to aggravate after a primary relief of symptoms. In the severe types where vomiting and general weakness were plainly manifested, proctoclysis of 5 per cent soda bicarbonate solution, one pint every six hours, was of distinct benefit. It gave the system its desired and easily absorbable alkaline fluid which showed at once in the increased urinary output with lessening of the toxemic symptoms. Subcutaneous injection of 500 c.c. of normal saline solution in the serious cases also gave the most pleasing and gratifying results. When the stomach was retentive, full and massive doses of potassium citrate, 120 grains in twenty-four hours, rendered the urine promptly alkaline and gave some definite relief of symptoms. Urotropin in small and large doses in both acid and alkaline urine gave no positive results or relief. Opiates

were used to relieve pain and were not held back in their administration. The infection usually ran a rather definite course of from seven to seventeen days' duration before the temperature and pulse rate became normal and the kidney and suprapubic areas of tenderness had disappeared, yet the pyuria and bacilluria in a number of cases continued without systemic manifestations all through the remaining months of pregnancy, and in several instances for some weeks after delivery. Hot applications over the kidneys were more soothing and better tolerated than cold. All foci of infection to which any attributing causative factor could possibly be traced were removed, as for example, suppurating alveolar abscess and infected tonsils. The acute cases require liquid diet, but as soon as possible easily assimilated, highly nutritous diet is essential.

The interruption of pregnancy in one case was followed by the immediate amelioration of symptoms and prompt return to normal. More pronounced and prompt was the recovery in this case, even though the condition was more grave than in those cases which were allowed to continue to term. The most gratifying results were obtained in cases that were conservatively treated, where no cystoscopic examination or ureteral catheterization was performed, and where the bladder was relieved of its residual urine and kept properly irrigated when the cystitis symptoms were excessive and troublesome to the individual.

## SUMMARY

Pyelitis is a common complication of pregnancy. There is, as yet, no one specific cause on which to place the blame; it is rather the result of generally associated causes. The onset at first is mild and insidious, usually beginning after the bladder is drawn up out of its normal nonpregnant position from the third month onward. Bacilluria and frequent urination are present and usually precede the systemic manifestation of pathologic change in the kidney substance. The renal infection is primarily of hematogenous origin. The blood stream culture is invariably negative, because of the high germicidal qualities in the maternal blood. Obstruction along the lower urinary tract in most cases is an essential factor in promoting infection of the kidney and its pelvis. The infecting organism is most commonly found to be the colon bacillus. This organism may be the primary offending or a secondary invader upon an infection produced by other pyogenic organisms.

The prognosis is excellent for the continuation of pregnancy with conservative measures; in only the exceptional case is it necessary to terminate pregnancy.

1810 South Rittenhouse Square. (*For discussion see p.* 744.)

# ABDOMINAL HYSTEROTOMY UNDER MORPHINE, SCOPOLAMINE AND LOCAL ANESTHESIA*

By Frederick C. Irving, M.D., Boston, Mass.

*(From the Department of Obstetrics of the Harvard Medical School.)*

THE indications for emptying the pregnant uterus in such serious conditions as heart disease where compensation has once failed, nephritis, and pulmonary tuberculosis are usually clear and definite. By removing the additional burden of gestation we may hope in many instances to restore the patient to a fair degree of health, or failing that, to save her from the immediate danger of death. The means of accomplishing this end, however, have always been far from satisfactory. We are confronted with a very sick individual whose end may actually be hastened if the method of delivery is injudiciously selected. Either the procedure we adopt or the anesthetic may be to blame in such an event. To avoid these dangers, so far as possible, I wish to suggest the use of abdominal hysterotomy under morphine, scopolamine and local anesthesia. Although the method is not perfect, I believe that our results in this class of patients are better than with delivery by any other method, since it provides us with a means of emptying the uterus devoid of any danger from the anesthetic and almost free from operative shock.

Before passing to a description of the technic employed and a summary of the results obtained I wish to bring out (1) the advantages of abdominal hysterotomy over the induction of labor or vaginal cesarean section and (2) the superiority of local anesthesia combined with morphine and scopolamine narcosis to general anesthesia.

The induction of labor is slow and uncertain. The uterine contractions set up by the introduction into the cervix of dilating bags, packs or bougies occasionally diminish or disappear. This necessitates the termination of labor either by vaginal cesarean section or by accouchement forcé, both of which require general anesthesia. On the other hand, should labor progress satisfactorily, the patient is afforded no escape from physical suffering or mental anxiety, both of which we believe are particularly injurious to women with heart disease who have experienced an attack of decompensation. Moreover, the induction of labor affords no opportunity to sterilize the patient and thus prevent the repetition of the same or a worse condition which might prevail were she not incapacitated for future pregnancy.

*Read by invitation, at the Forty-eighth Annual Meeting of the American Gynecological Society, Hot Springs, Va., May 21-23, 1923.

Vaginal cesarean section becomes increasingly difficult the nearer the approach to term, nor does it allow of sterilization. Abdominal hysterotomy may be easily performed at any stage of pregnancy, although up to the fourth month some difficulty may be encountered in drawing up the uterus for incision. Resection of the tubes following abdominal hysterotomy is, of course, a simple matter.

Ether is by no means free from danger. Kemp has shown that it produces a marked contraction of the renal vessels without a rise in peripheral blood pressure. There results a diminution in the secretion of urine and in some cases its complete suppression. Enough injury may be done to the kidneys to produce albuminuria and hematuria. The work of Rogers indicates that the detrimental effect of ether vapor in pulmonary tuberculosis is largely due to an aspiration bronchopneumonia. The deep breathing which ether induces results in bacteria-laden material being drawn from a preexisting focus and deposited in other portions of the lungs by way of the bronchioles. The injurious effect of this anesthetic upon diabetics by causing acidosis is too well known to need comment. No definite proof has been presented that ether injures the heart directly. There is no doubt, however, that a number of cardiacs have died from heart failure during or after ether anesthesia. This is apparently due to an increase in blood pressure resulting from respiratory spasm during the induction period, or later in the course of the anesthesia from failure to maintain an open airway.

Chloroform may be dismissed with a few words. Experimentally it causes degeneration of the liver and the cardiac muscle. According to McDowell the muscular coat of the bronchioles, which by its normal contraction prevents the admission of infectious material to the alveoli, is paralyzed by this anesthetic. The lung tissue may thus actually be destroyed, which would indicate that chloroform is not even safe for use in respiratory conditions.

Nitrous oxide is rapidly eliminated and produces no tissue changes in any organ. Combined with oxygen and skillfully administered it is an ideal anesthetic for the normal patient, provided no great degree of relaxation is required. However, in both heart disease and nephritis, should cyanosis occur, the blood pressure rises with disastrous results. It is thus evident that if gas-oxygen is used in the class of cases we are discussing, the safety of the patient lies to a great extent in the hands of the anesthetist. It would seem better that it should lie entirely in the hands of the surgeon.

In 1910 Smith and Schwartz reported two cesarean sections done under local anesthesia. In 1915 Webster reported 16 cases and stated that he had first done the operation in 1909. Cases have also been reported in 1918 by Trout and by Brown, in 1920 by Slemons and

Johnson, in 1921 by Mowery, and in 1922 by Waldstein. In none of these cases was a systematic attempt made to induce preliminary narcosis by the use of morphine and scopolamine.

In 1916 I performed abdominal hysterotomy under morphine, scopolamine and local anesthesia upon a patient who, in brief, presented the following history. She entered the hospital with the diagnosis of rheumatic heart disease, with mitral stenosis. After admission she suffered a severe attack of decompensation. She had orthopnea, dyspnea, cyanosis, cold extremities, cough, vomiting, edema of the lungs and enlargement of the liver. The pulses were unequal, of poor quality and very rapid. A venesection was done and morphine and strophanthin given. Under rest and digitalis the patient had improved sufficiently twelve days later to justify emptying the uterus, the pulse then being about 110. The procedure was completed without incident and a five months' macerated fetus delivered. The patient slept throughout the operation and remembered nothing about it. She made a good convalescence and five weeks later was up and doing light housework about the ward.

The operation under local anesthesia was accompanied by morphine and scopolamine narcosis because it seemed a distinct advantage to have the patient oblivious to what was going on and thus avoid the psychic element, and because it was felt that novocaine would better produce its effect if thus supplemented. This proved to be the case. Only four of the thirty-one cases operated on by this method have had any recollection whatever of the operation, and those who remembered anything had a very indistinct impression of what went on. Patients thus operated on are spared the apprehension attendant upon local anesthesia without morphine and scopolamine narcosis. The freedom from anxiety and nervous tension thus obtained is not only of great benefit in heart disease on the verge of decompensation, but it makes hysterotomy under local anesthesia more merciful in all cases where the operation is indicated.

The technic which I have used is as follows:

About two and a half hours before beginning the operation the patient is placed in a darkened room adjacent to the operating room and, for the purpose of keeping out extraneous sounds, her ears are plugged with cotton soaked in oil. She is then given subcutaneously, morphine gr. $\frac{1}{6}$ and scopolamine hydrobromide gr. $\frac{1}{200}$. The morphine is not repeated, but at forty minute intervals the same amount of scopolamine is administered until the patient is dozing. Usually three or four supplementary doses of scopolamine are necessary. When the patient falls asleep a folded towel is placed over her eyes and she is transported gently to the operating room and placed upon the table. A nurse sits by her head and records the pulse rate at frequent intervals, but nothing is said to the patient under any circumstances. Absolute quiet is enjoined upon everyone in the room and the rattling of instruments or basins is carefully avoided. At this point another dose of scopolamine, gr. $\frac{1}{200}$, is given.

The site of the incision, which starts just below the umbilicus and ends above the pubis, is now infiltrated with 1 per cent novocaine, using a hypodermic syringe with a fine needle. With a larger needle and syringe the operator next injects the subcutaneous tissue and partially infiltrates the fascia by a series of punctures made downward at right angles to the skin surface. He now waits five minutes by the clock. If he starts the skin incision earlier he will arouse the patient and immediately get into difficulties.

At the end of five minutes he divides the skin and subcutaneous tissue, further infiltrates the fascia and incises it. The peritoneum is now injected with novocaine

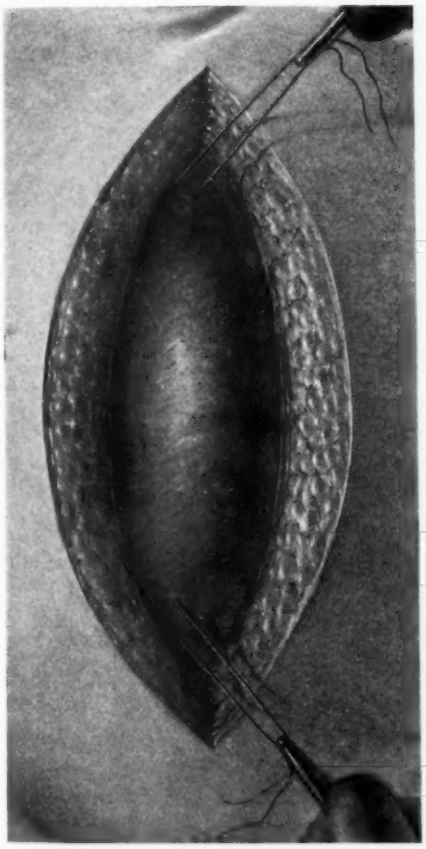

Fig. 1.—Two stay sutures have been introduced into the uterine muscle somewhat to the right of the midline. Traction by an assistant on these sutures holds the uterus in close apposition to the abdominal wall and corrects the usual right lateral torsion of the organ.

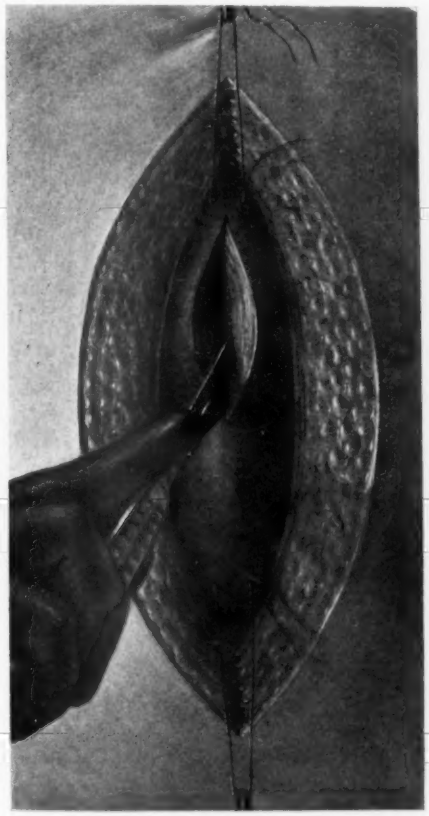

Fig. 2.—The uterus is incised between the stay sutures.

and opened in turn. The lower angle of the incision is drawn downward and to the right, and a stay suture of chromic catgut passed into the uterine muscle just above the bladder reflection of the peritoneum. With this suture left loose, the upper angle of the incision is now drawn upward and to the right, and a second stay suture placed.

As the assistant draws upward on the stay sutures he not only holds the uterus

in apposition to the abdominal wall and thus minimizes the spill of uterine contents into the peritoneal cavity, but he also corrects the usual right lateral torsion of the uterus by causing its anterior surface to rotate from right to left. In this way the incision made between the stay sutures will be more nearly in the median line of the organ than if that portion of it were incised which lay originally under the abdominal wound. (Fig. 1.)

Since the uterine muscle and its enveloping peritoneum are insensitive, no novocaine is here required. The viscus is opened cleanly between the stay sutures with a sharp knife. (Fig. 2.) If pregnancy has advanced beyond five months, the

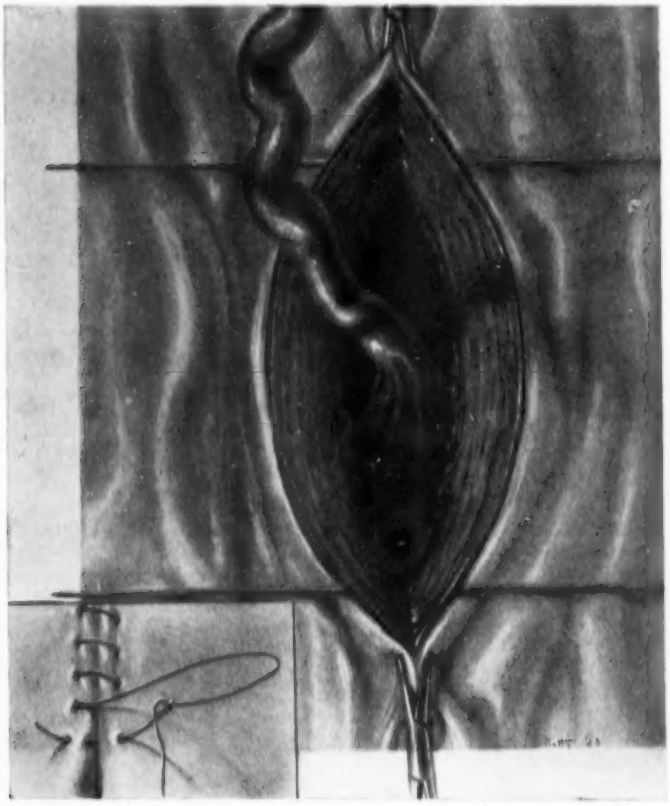

Fig. 3.—That portion of the uterus immediately surrounding the incision is temporarily fixed to the abdominal wall by two sharpened knitting needles which replace the stay sutures.
The small drawing shows the overlapping stitch with which the uterine serosa is closed.

membranes are ruptured, a foot grasped and the fetus extracted in the usual manner. If pregnancy has not reached five months, the intact ovum is separated by the fingers so that it lies free in the uterine cavity and is extruded through the uterine wound by pressure on the sides of the abdomen. In this way one may be sure that the uterus is completely empty.

The uterine musculature just beyond each end of the incision is now transfixed by a long, sharpened steel knitting needle which replaces the stay suture. The portion of the organ which we wish to suture now rests temporarily suspended in the abdominal wound, leaving the hands of the assistant free for other purposes,

effectively preventing any further spill and acting as a plug to prevent the extrusion of intestines. A towel is now placed on either side of the uterus under the needles and clamped to its fellow of the opposite side above and below. (Fig. 3.) If the patient is in the second half of pregnancy and the placenta consequently has not been removed with the ovum, it is now extracted. The operator then sutures the uterus in three layers, the first continuous, the second interrupted, and the third, the peritoneal stitch, which is continuous, is designed to overlap the serosa and give extra security against leakage through the wound.

If it is desired to sterilize the patient the long needles are removed and the uterine cornu on one side is located and drawn into the abdominal wound with a double tenaculum. (Fig. 4.) Since the tube is sensitive, the mesosalpinx below its proximal end is infiltrated with novocaine. A mattress suture is now placed beneath the uterine insertion of the tube and a half hitch made in it. The proximal inch and a half of the tube is excised, its uterine portion being removed by a wedge-shaped incision, and the mattress suture tightened by the assistant as this is done,

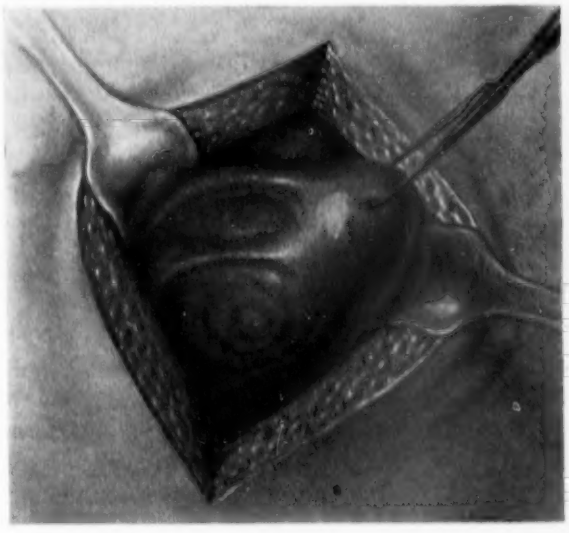

Fig. 4.—The right uterine cornu is drawn into the abdominal wound by a double tenaculum, exposing the proximal end of the right fallopian tube for excision.

thus checking bleeding. The cut end of the distal portion, having previously been ligated, is buried between the leaves of the broad ligament and all peritoneal surfaces approximated.

The same process is repeated on the other side and the abdominal wall closed. The sponging of any small amount of blood that may be left in the peritoneal cavity should be avoided as it will arouse the patient. The same holds true of traction on the parietal peritoneum, which should therefore be picked up in tissue forceps for suture instead of by the usual method of applying a number of hemostats. Before being put to bed a final dose of scopolamine is given.

Occasionally the patient mutters incoherently during the operation, and sometimes become somewhat delirious. This does no harm and need not disconcert the operator. Enough restlessness occurred on two occasions to require primary ether and on two others to necessitate gas-oxygen. This complication took place among our earlier cases and has been avoided in our later work by the use of the purest

preparation of scopolamine obtainable, and by more careful attention to details of technic. Postanesthetic vomiting is of course absent and operative shock is reduced to a minimum.

Thirty-one cases have been operated on by Dr. Newell, myself and other members of the staff of the Boston Lying-in Hospital at stages of pregnancy varying from seven weeks to full term. Fifteen viable infants were delivered and all survived. No injurious effect of morphine and scopolamine upon the fetus has been noted. It has been our experience that babies thus delivered have cried more promptly than those removed from the uterus when operating under ether anesthesia, and it is our practice to have them taken immediately from the operating room lest they arouse the patient.

## INDICATIONS

*Cardiac disease.* Seventeen cases of heart disease who had been decompensated have been delivered by this method. In seven, previous breaks in compensation had been restored by appropriate treatment. One of these seven patients died of pulmonary embolism on the seventh day after a week of normal convalescence.

There were nine cases in which compensation had not been completely established but in which delivery seemed indicated because the patients were losing ground. One patient died from cardiac failure on the seventh day, and a second, who entered with the additional diagnosis of preeclamptic toxemia and with a blood pressure of 260/160 died of cardiac failure on the third day.

One patient entered in labor, badly decompensated and rapidly growing worse. Abdominal hysterotomy under morphine, scopolamine and local anesthesia was done because it seemed to offer the only possible chance of bringing the patient through alive, but death occurred in 24 hours from cardiac failure.

*Cardiorenal disease.* Two patients with cardiorenal disease were thus delivered with no deaths.

Of the 19 patients in whom the heart was affected, 4 died, a mortality of 21 per cent. If we deduct the case that died of pulmonary embolus on the seventh day as not being directly due to the condition for which the operation was undertaken we have a mortality from heart disease of 15.8 per cent. Since all these patients were extremely bad surgical risks we feel that our mortality would have been higher had we adopted any other method of delivery.

No further deaths occurred in the remaining 12 cases, which were operated on for the following indications: *Nephritis*, 3 cases; *pulmonary tuberculosis*, 3 cases, *diabetes*, 2 cases, one of whom had previously had a cesarean section.

*Other indications.* Three cases remain, all of whom had previously

been delivered by cesarean section. One had acute bronchitis and was in labor, the second, bronchial asthma and the third requested this method to avoid the discomfort of general anesthesia.

## CONCLUSIONS

(1) Abdominal hysterotomy offers a method of emptying the uterus easily and rapidly in those cases where such a procedure is demanded.

(2) Local anesthesia under morphine and scopolamine narcosis is superior to general anesthesia because any possible danger from an inhalation anesthestic is eliminated and operative shock is reduced to a minimum.

(3) This method is, therefore, applicable to patients classed as bad surgical risks. Among such are cardiacs with previous decompensation, nephritics, diabetics, the pulmonary tubercular, or those who have acute respiratory infections upon whom it is necessary for other reasons to perform cesarean section.

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443 BEACON STREET.

(*For discussion see p.* 749.)

# HYDROURETER AND HYDRONEPHROSIS: A FREQUENT SECONDARY FINDING IN CASES OF PROLAPSE OF THE UTERUS AND BLADDER*

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THE possibility that certain secondary changes in the urinary tract may result from the very marked bladder dislocation which associates practically all cases of prolapsus uteri has led to the present study. Clinically, we have repeatedly noticed the sallow, weazened expression of patients with long standing prolapse, their appearance of premature senility, though they may be of the fourth decade of life, indications of more serious functional disturbances than would arise from the mere physical deformity of the uterus. Uremic and suburemic manifestations are not infrequent in these patients, and are particularly apt to be encountered after an operation for the cure of genital prolapse. The operation, moreover, is still attended by an appreciable amount of shock which can not be accounted for by the duration of the anesthesia, loss of blood or by so-called surgical trauma.

The occurrence of postoperative shock in these cases, formerly more common than nowadays, was believed by us to be due to the prolonged sharp traction on the cervix during the operation. This traction on the cervix exerts in its turn a pull upon the ureters and kidneys and causes an irritation of their sympathetic ganglia including the adrenals. We have since learned from the study of ten cases of prolapse and one case of large cystocele without uterine prolapse that definite mechanical effects are produced in the ureters and kidneys by the uterine prolapse, and that these patients are necessarily predisposed to shock and uremia because of the damage to the kidney parenchyma. The effects upon the urinary tract by the dragging, prolapsed uterus are mainly to be seen in hydroureter and hydronephrosis.

Medical literature appears not to contain any clinical account of this association between uterine prolapse and kidney-ureter dilatation. Undoubtedly many gynecologists have noticed dilated ureters in cases of procidentia. There has, hitherto, been no general recognition of the fact that the uterine prolapse may bear an etiologic relationship to the ureter dilatation. The only reference to this fact that has come

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to our notice is to be found in the anatomic study of genital prolapse by Tandler and Halban. These authors report the incidental finding of 15 instances of dilated ureters out of the 23 autopsies described by them. Froriep, quoted by Tandler and Halban, mentions a finger-wide dilatation of the ureters in a case of hypertrophy, elongation of the cervix and prolapsus uteri and ani without cystocele. He supposed that the dilated ureters resulted from stasis in the bladder and kinking of the urethra. Tandler and Halban observe that, whereas

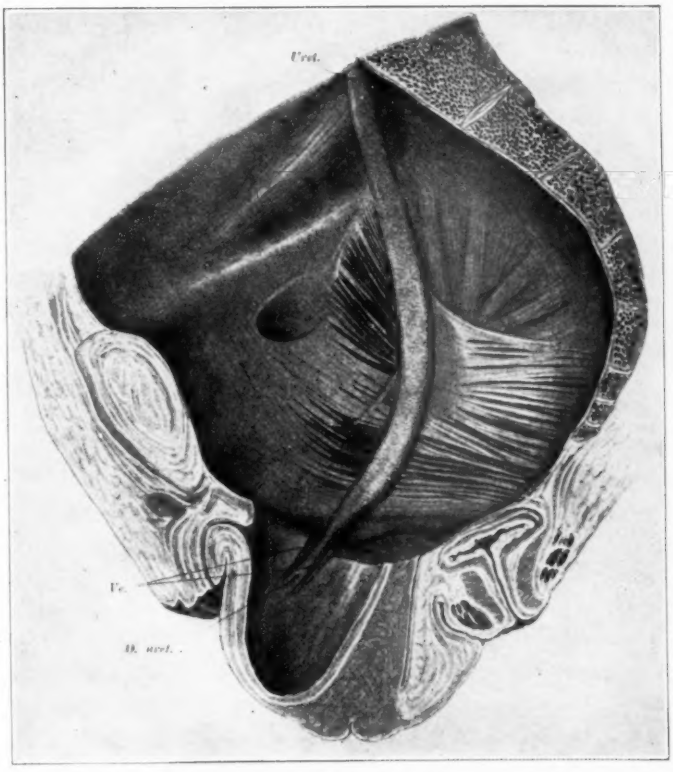

Fig. 1.—Hydroureter associated with uterine prolapse. Dilatation of almost entire length of ureter. Vesical end of ureter remains unchanged. (From Tandler and Halban, Genital Prolapse, Vienna, 1907.)

Froriep regarded this pathologic association between uterus and ureters as exceptional, their own investigation proved that ureteral dilatation and hypertrophy so frequently accompanied the prolapse as to constitute it a typical finding. Hirokawa in 1911 described two cases of genital prolapse in which ureter dilatation was noted at autopsy and discussed the relation between these two conditions.

The ureter dilatation was as wide as a finger (Fig. 1) in five of the cases described by Tandler and Halban, but, as a rule, varied with the size of the cystocele. According to these authors the dilatation

of the ureters is, generally, proportionate to the size of the cystocele. When the latter is slight the former is moderate or even quite absent. The whole ureter is dilated with the exception of its distal portion near the bladder entrance. This portion retains its normal caliber and thickness. The point of demarcation between the dilated and nondilated portions of the ureter was held by Tandler to correspond to the margin of the hiatus genitalis, i.e. the levator edges. The constriction to which the prolapsed bladder is subjected at this genital rupture ring is shared by the ureters and hence result the stasis and dilatation.

A hydroureter was not found by Tandler and Halban in those cases where the cystocele was so small as to permit the ureter to empty into the bladder above the hiatus genitalis. When the rupture ring was very wide the ureters escaped stenosis, because the neck of the bladder was not constricted. Furthermore, the absence of dilated ureters in the autopsies studied was explained by them on the ground that in the living state a pessary may have been worn, in which case despite the cystocele there was no compression at the hernial ring. Histologically, they found a uniform hypertrophy of the entire musculature. Elongation of the ureter was present in all their cases.

From Tandler and Halban's postmortem studies the association of dilated ureters with prolapse of the genitals appears fairly well established. While Froriep has referred to hydronephrosis as also occurring with the prolapse in the one section made by him, Tandler and Halban speak only of the ureters. They made no observation on the kidneys because in their autopsy material these had been previously removed. It seems almost too obvious to mention that hydronephrosis should be present when hydroureters are found. Tandler and Halban assumed that the kidneys in their autopsy material, though not seen by them, must have been the seat of hydronephrosis. While dilated and hypertrophied ureters by themselves can have very little clinical importance, dilated kidney calyces with parenchymatous compression may be of serious consequence to the patient.

### THE MECHANISM BY WHICH SECONDARY HYDROURETER AND HYDRONEPHROSIS MAY BE PRODUCED

Dilatation of the ureters associating genital prolapse may be produced theoretically in several ways:

1. Kinking of the urethra and stasis in the cystocele; (hour glass formation of the bladder)
2. Intramural stretching in the bladder wall with stenosis.
3. Compression of the ureters outside the bladder.

Kinking of the urethra was given as a cause by Froriep. If this were the rule, however, these patients would suffer from great urinary

difficulty, which is not common. On the contrary there is more apt to be incontinence. Furthermore, as Tandler and Halban remark, the stasis of the ureter begins above the hiatus genitalis. If the latter is wide the ureters are not dilated, though the cystocele may be marked. When the ureter empties into the bladder at a point above the hiatus genitalis it is also not dilated.

Intramural stenosis of the ureter probably is not the cause of ureter dilatation, because the distal portion is normal for two or three centimeters from the bladder wall. This latter fact indicates the point of compression to be from outside the bladder. Tandler and Halban

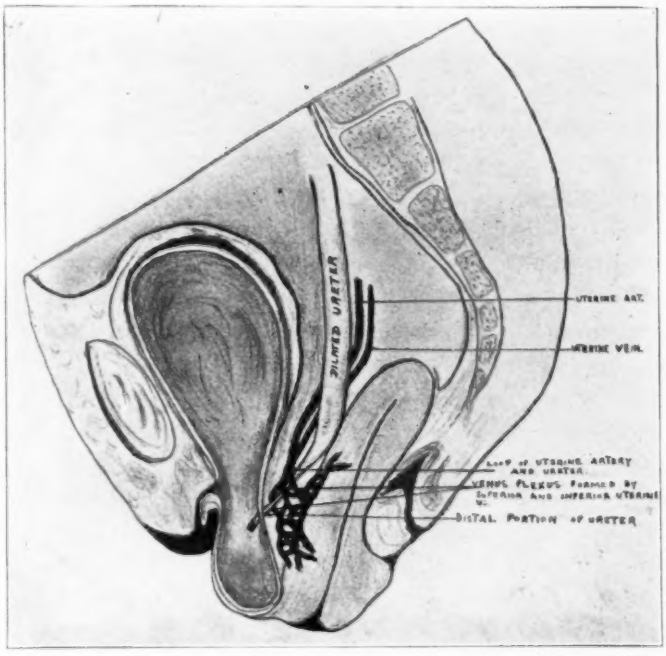


Fig. 2.—Constriction of the distal portion of the ureter by the uterine artery and veins in genital prolapse (schematic).

maintain this to be the edge of the levators which form the hernial ring of the genital prolapse. Their anatomic specimens apparently illustrate the point made by them. Inasmuch, however, as the levators are frequently so stretched as to be very thin, weak muscle bands, while on the other hand the bladder capacity varies frequently throughout the day, this cause is more apparent than real. Were the bladder a solid organ it would with the uterus form a sufficient body to cause constant and effective compression of the ureters against the levators, resulting in stenosis and dilatation. In the absence of this factor, the bladder would have to be filled constantly with a

sufficient quantity of urine to produce hydrostatic pressure on certain fixed points of the ureters. Owing to the frequent emptying of the bladder in these cases, the hypothesis of the constriction at the hiatus genitalis obviously does not hold true for all the cases.

Another factor besides compression of the levators or the cystocele must therefore be present to account for the constriction of the ureters, and we believe this to be by the uterine artery and uterine veins. The ureter is looped by the uterine artery which crosses it in the paracervical tissues. The uterine veins form a plexus which, with the artery, surrounds the ureter entirely (Fig. 2). Although an elongation of the ureter and the uterine artery takes place in more or less parallel fashion, the pull in the ureters exerted by the abnormally dependent cervix and uterus forms a constriction at about the point where the postmortem studies of Tandler and Halban and our pyelograms on the living subject show it to be. Inasmuch as the veins are frequently distended, almost varicose through prolonged stasis, and thickened, it is not difficult to see how vascular constriction of the ureter may result. Hydronephrosis due to kinking of the ureter by abnormally large vessels at any point along the course of the ureter has been described by Howard Kelly and others.

The loop formed by the ureter and uterine artery (the urovascular loop) would therefore be a point of predilection for ureter constriction under the abnormal anatomic circumstances which exist in genital prolapse. In this connection it may be mentioned that this point forms another of the physiologic constrictions of the ureters in women. Ureter stones are very apt to be caught at that point. Moreover, the great frequency with which Hunner encounters strictures in the ureters in women may also be partly explained by this anatomic relationship between ureter and uterine vessels.

The urologic examination of the ten cases of genital prolapse and one case of cystocele not associated with prolapse has been undertaken, first to demonstrate the clinical presence of hydroureter and hydronephrosis, and secondly to determine the degree of kidney damage, so as to help us formulate more precise operative indications and contraindications in these cases. We have adopted the plan of first testing the capacity of the ureters and renal pelvis and then resorting to pyelography. Only one ureter and renal pelvis need be injected to serve for demonstration purposes, and also to avoid the unnecessary pain which very often accompanies the pyelography. In this work we have been fortunate in enlisting the cooperation of Dr. A. Hyman, associate urologist to the hospital. The cystoscopic examinations, as herein reported, were practically all made with his assistance.

CASE REPORTS

CASE 1.—M. S., aged sixty-eight, had been married 40 years, 6 children; menopause 15 years ago. Urinates 5 to 6 times a day, prolapse for the past 6 years, pessary not worn by patient.

*Examination.*—Large cystorectocele and complete prolapse of uterus. (Fig 3.)

*Cystoscopic Findings.*—Numerous superficial diverticula. Left ureter obstructed at 1 cm. from orifice; a No. 6 catheter then passed point of obstruction. Right ureter also obstructed at the same distance from the meatus when the catheter finally passed. A profuse flow of clear urine from both sides followed. Pressure over kidney caused acceleration of flow which was already rapid. Bladder was emptied in order to determine reflux, but none was present. The left ureter was injected and tolerated 30 c.c. of sterile water. The right ureter tolerated 25 c.c.

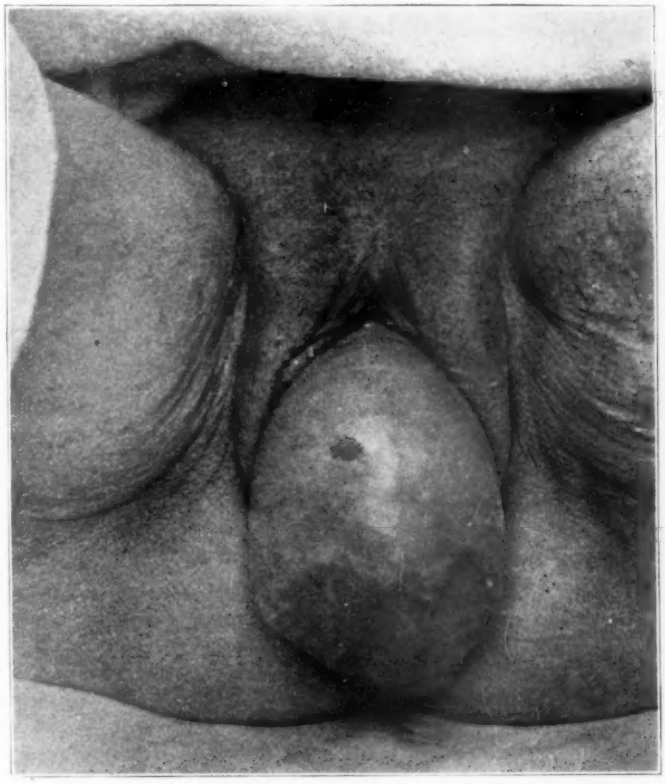

Fig. 3.—Photograph of Case 1, complete procidentia.

*Urine examination of cystoscopic specimen.*—Left: urea, 12 mg. per c.c.; microscopic, numerous clumps of white blood cells.

*P. S. P. Output.*—First 2 hours 25 per cent; third hour 25 per cent.

*Urine examination on admission.*—Faint trace of albumin, sugar 1.8 per cent, occasional red blood cells, acetone and diacetic acid present.

*Blood chemistry.*—Urea nitrogen 26.6, incoagulable nitrogen 56.6, sugar 0.172.

*Blood pressure.*—150/90. Pyelograms were made. (Fig. 4.)

CASE 2.—S. M., aged fifty-eight, had been married 32 years, four children, oldest

28 years, youngest 19 years. Menopause 9 years ago; prolapse for the past 8 years; patient has worn a ring pessary.

*Examination.*—Small rectocele, lacerated cervix, slightly eroded; huge cystocele the whole bladder being prolapsed. (Fig. 5.)

*Cystoscopic examination*—Bladder completely prolapsed through introitus. Right ureter found after restitution of bladder. A catheter was easily introduced, and passed up to the kidney pelvis. Owing to numerous folds and distortions the

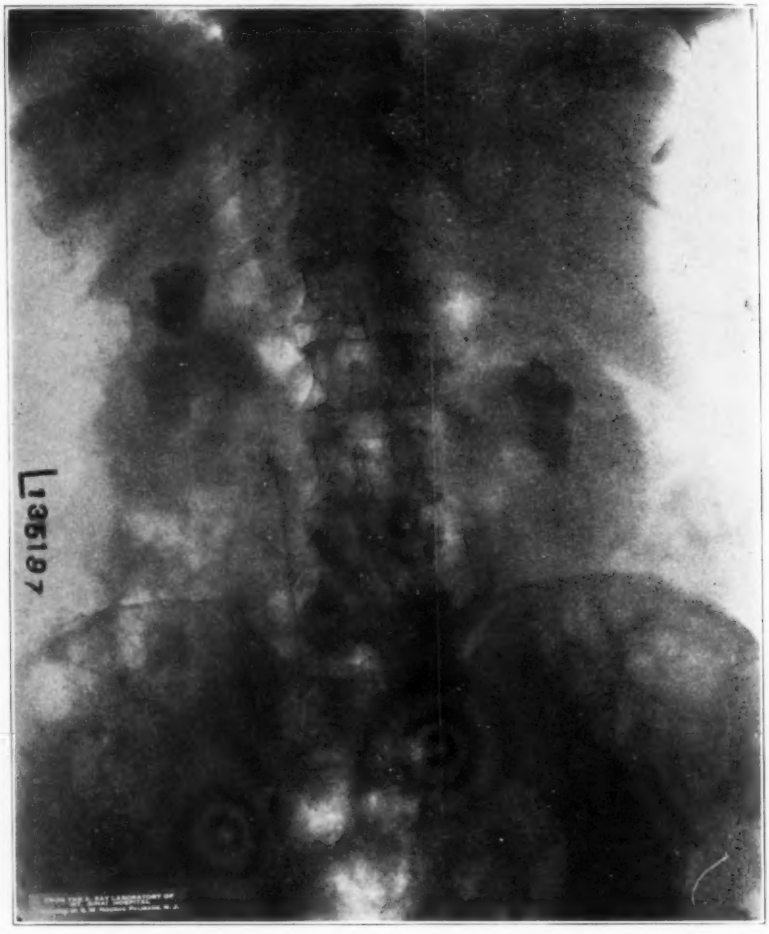


Fig. 4.—Pyelogram (sodium bromide) in Case 1, showing bilateral hydroureter and hydronephrosis. The right ureter is distended with the opaque solution. The left renal pelvis is dilated; left ureter is empty of opaque solution.

left ureter was more difficult to identify. But with the removal of pessary and vaginal manipulation restoring the normal relations of the trigone, the left ureter was located and a catheter passed up for a distance of 5 cm. A test tube filled in 2½ to 3 minutes on the right side. On the left side the test tube filled considerably slower. Ureter orifices fairly small. Good concentration of indigo-carmine on left side in 10 minutes; faintly on right. Introduced 6 c.c. of sterile water into left ureter. Patient complained of severe pain on left side. Fifteen c.c. of water was introduced on right side before patient complained of pain.

*Diagnosis*—Hydronephrosis of right kidney. No pyelogram was taken. Note the unilateral hydronephrosis in complete procidentia in case where a pessary support was worn from almost the beginning of the prolapse.

CASE 3.—F. B., aged fifty-four; had been married 34 years; 4 children, menopause at 48 years. Prolapse for the past ten years; protrusion has become worse during past two months. No pessary had been worn by her.

*Examination*—Complete prolapse of the uterus. Large cystocele.

*Cystoscopic findings*—Bladder markedly prolapsed and deformed. Ureteral ori-

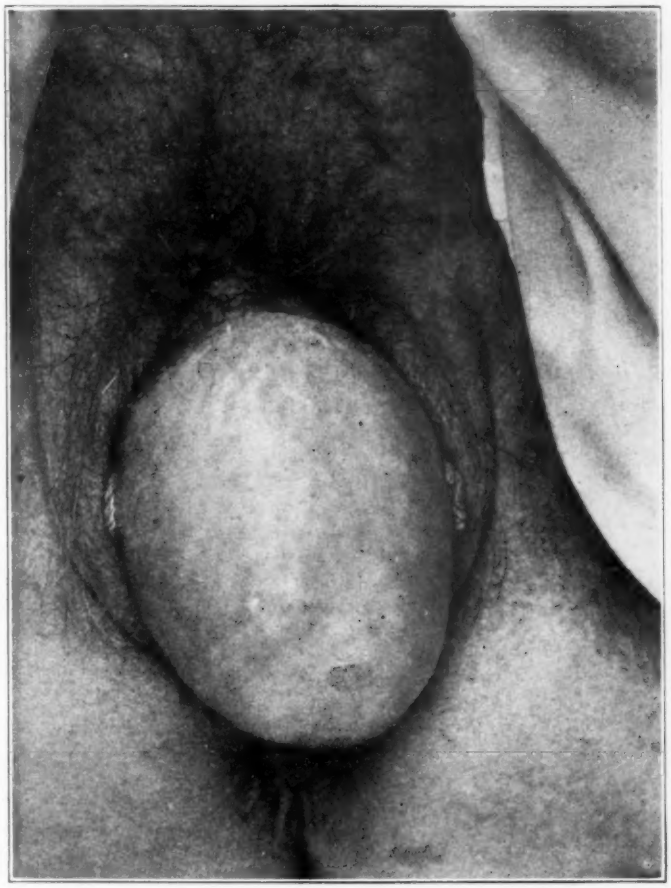

Fig. 5.—Photograph of Case 2. Complete procidentia. Unilateral hydroureter, capacity of right renal pelvis and ureter 15 c.c. (patient had worn a pessary).

fices could not be seen until cystocele was reduced. No cystitis found. *Right ureteral mound* was very prominent. No obstruction in ureter to passage of catheter. On aspiration, the pelvis was found filled with about 14 c.c. of urine. No indigo carmine appeared in 35 minutes. Profuse flow from the kidney. Capacity of renal pelvis was 35 c.c. *Left ureteral mound* was not as prominent as the right. No obstruction in the ureter and no retention. Normal flow. Good indigo-carmine output in 10 minutes. Capacity of renal pelvis not tested.

*Diagnosis*—Right sided hydronephrosis.

*P.S.P. Output*—First 2 hours 90 c.c., 45 per cent; second 2 hours 50 c.c., 25 per cent; four hours total 70 per cent.

*Urine examination of cystoscopic specimen*—

| | right | left |
|---|---|---|
| urea | 2.6% | 0.95% |
| microscopic | many red blood cells, numerous epithelial cells, few white blood cells. | numerous red blood cells many epithelial cells. |

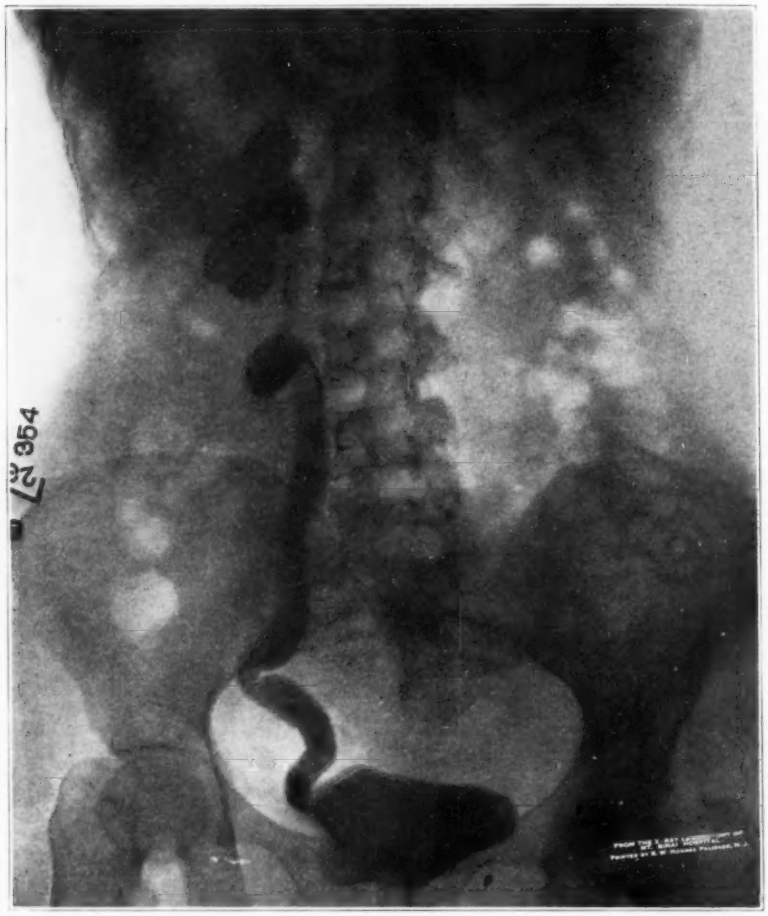


Fig. 6.—Pyelogram of the left ureter and renal pelvis in Case 4. Complete prolapse. Capacity of left ureter 50 c.c., of right ureter 25 c.c. The ureter is markedly distended, tortuous and elongated. The distal end is normal. The bladder contains reflux bromide solution.

*Urine examination on admission*—

| Amt. | Char. | Reaction | Sp. Gr. | Alb. | Sugar | Microscopic |
|---|---|---|---|---|---|---|
| q.s. | clear | acid | 1030 | faint trace | 0 | many hyaline casts and white blood cells. |

*Blood chemistry*—Urea nitrogen 25.2; incoagulable nitrogen 50.0; uric acid 5.2; creatinin 1.1.

*Blood pressure*—160/80. Pyelogram on right ureter taken.

CASE 4.—C. R., aged forty-five; married 17 years, 3 children. Prolapse of 6 years' duration; no pessary had been worn by her.

*Examination*—Complete prolapse of uterus, cystocele.

*Cystoscopic findings*—Bladder negative, both ureters catheterized. Capacity of left ureter over 50 c.c. Capacity of right ureter 25 c.c.

*Diagnosis*—Bilateral hydroureter and hydronephrosis.

*Urine examination of cystoscopic specimen*—

| | Right | left |
|---|---|---|
| urea | 1.6 mg. per c.c. | 1.8 mg per c.c. |
| microscopic | very many epithelial cells, few red blood cells, no pus cells, no casts. | some epithelial cells no red blood cells, no casts. |

*Urine examination on admission*—

| Amt. | Char. | Reaction | Sp. Gr. | Alb. | Sugar | Microscopic |
|---|---|---|---|---|---|---|
| q.s. | clear | acid | 1020 | 0 | 0 | negative |

*Blood chemistry*—Urea nitrogen 12.6 mg. per 100 c.c.; incoagulable nitrogen 42.3 mg. per 100 c.c.: uric acid, quantity not sufficient for determination; cholesterin 0.142 per cent.

*Blood Pressure*—130/78. Pyelogram of left ureter was made. (Fig. 6.)

CASE 5.—A. K., aged sixty-three, married 40 years, 6 children; oldest 35 years, youngest 27 years. Patient has had prolapse for 14 years, during which time she has worn a pessary. For the past 8 months patient has not worn this pessary and prolapse has become increased.

*Examination*—Prolapse of atrophic uterus, with a moderate size cystocele and small rectocele.

*Cystoscopic findings*—The bladder shows the usual deformity in prolapse; both ureteral mounds are prominent. The ureter catheters on both sides met with some obstruction at 3 cm. This obstruction was readily overcome and ureters catheterized to pelvis. Clear pale watery urine from both kidneys; rather rapid flow. Capacity of right pelvis, 14 c.c., left pelvis 18 c.c.

*Diagnosis*—Hydronephrosis of both kidneys. No pyelograms taken.

CASE 6.—B. K., aged forty-four, married 14 years; 4 children living and well. Chief complaint, frequent urination. Periods have been normal except for diminution in flow; prolapse of uterus for the past 2 months. No pessary worn.

*Examination*—Partial prolapse of uterus and also of anterior vaginal wall.

*Cystoscopic findings*—Bladder distended, ureteral meati normal. Right ureter catheter was obstructed just within the meatus and finally overcame it occasioning some traumatic bleeding. Very slow flow, capacity of pelvis 8 c.c. Left ureter catheterized without obstruction, clear urine obtained. Capacity of pelvis 12 c.c. Findings indicate a very moderate dilatation of the left pelvis and a normal right pelvis.

*Urine examination of cystoscopic specimen*—

| | right | left |
|---|---|---|
| urea | 1.6 mg. per c.c. | 1.8 mg. per c.c. |
| microscopic | many red blood cells, occasional hyaline casts | occasional granular cast |
| Guaiac | Positive | Negative |

*Urine examination on admission—*

| Amt. | Char. | Reaction | Sp. Gr. | Alb. | Sugar | microscopic |
|---|---|---|---|---|---|---|
| q.s. | clear | acid | 1020 | faint trace | 0 | few white blood cells |

*Blood chemistry*—no blood for chemistry taken.

*Blood pressure*—120/90. No pyelograms were made.

CASE 7.—A. A., aged fifty, had been married 30 years; 5 children. For the past 20 years patient has had prolapse of the uterus. This has steadily increased in size so that now a mass the size of a large orange protrudes. For the past year she has complained of pain in the pelvis, and in the prolapsed organ. No pessary had been worn.

*Examination*—Complete prolapse of the cervix which is hypertrophied and slightly lacerated. The uterus is atrophic. There is a large cystocele and a small rectocele.

*Cystoscopic findings*—Besides the usual deformity of the bladder, as encountered in prolapse, there is no abnormality. Both ureters were catheterized without obstruction. A pale watery urine was obtained from both kidneys. The capacity of the right pelvis 8 c.c., the left pelvis 9 c.c.

*P.S.P. Output*—First hour, 26 per cent; second hour, 23 per cent.

*Urine examination of cystoscopic specimen—*

| | right | left |
|---|---|---|
| Urea | 1 mg. per c.c. | 1 mg. per c.c. |
| Microscopic | few epithelial and granular casts | marked epithelial casts. |

*Urine examination on admission—*

| Amt. | Char. | Reaction | Sp. Gr. | Alb. | Sugar | microscopic |
|---|---|---|---|---|---|---|
| q.s. | clear | acid | 1008 | trace | 0 | occasion hyaline and granular casts. |

*Blood chemistry*—no blood taken for chemistry.

*Blood pressure*—125/65. No pyelogram taken.

CASE 8.—B. G., aged forty-nine, married 29 years. Three children living and well. For the past 6 years patient has had prolapse of the uterus which is now constant. Complains of some pain in the pelvis, has never worn a pessary.

*Examination*—Large lacerated, eroded cervix, protruding through the vulva. Both vaginal walls protrude.

*Cystoscopic findings*—Bladder markedly deformed on account of prolapse. Both ureteral mounds prominent. Right ureter obstructed just within meatus and cannot be passed further. No specimen obtained. Capacity of pelvis cannot be determined as the blue injected cannot be returned. Left kidney, rather rapid flow, clear urine. Pelvic capacity 14 c.c. These findings indicate a moderate degree of hydronephrosis of the left kidney.

*Urine examination of cystoscopic specimen—*

| | right | left |
|---|---|---|
| urea | 1.8 mg. per c.c. | 1.8 mg. per c.c. |
| microscopic | negative | negative |

*Urine examination on admission—*

| Amt. | Char. | Reaction | Sp. Gr. | Alb. | Sugar | Microscopic |
|---|---|---|---|---|---|---|
| q.s. | clear | acid | 1024 | 0 | 0 | negative |

*Blood chemistry*—No blood for chemistry taken.

*Blood pressure*—155/95. No pyelogram taken.

CASE 9.—A. H., age forty-six, had been married 25 years; one child 24 years old, no other pregnancies. Falling of womb for 10 years. Has worn a ring pessary at irregular periods.

*Examination*—Moderate cystocele, large rectocele. Anterior lip of cervix is elongated and protrudes on deep straining to the introitus. Uterus slightly enlarged.

*Cystoscopic examination*—Ureters considerably displaced. Capacity of left pelvis is 6 c.c. Capacity of right pelvis is 8 c.c.

*P.S.P. Output*—First hour 410 c.c., 25 per cent; second hour 100 c.c., 16 per cent.

*Urine examination of cystoscopic specimen*—

| | right | left |
|---|---|---|
| urea | 18 mg. per c.c. | 14 mg. per c.c. |
| microscopic | many red blood cells. | negative |
| Guaiac | faintly positive | negative |

*Urine examination on admission*—

| Amt. | Char. | Reaction | Sp. Gr. | Alb. | Sugar | Microscopic |
|---|---|---|---|---|---|---|
| q.s. | clear | acid | 1020 | 0 | 0 | negative. |

CASE 10.—P. S., aged sixty-two years, unmarried, occupation that of infants' nurse. Falling of womb for the past 9 years. Menopause at 46 years; no pessary worn but supported it with a napkin. For the past 6 months she cannot replace it. There is no urinary difficulty.

*Examination*—Uterus is prolapsed; a small polypoid excrescence is present on anterior cervix lip. Perineum is intact. On deep straining a small cystocele becomes apparent.

*Cystoscopic examination*—Bladder normal. Catheters passed up to both kidney pelves. Clear urine obtained from each, no obstruction in either ureter. Capacity of right pelvis is 14 c.c., of the left pelvis is 12 c.c.

*P.S.P. Output*—First hour 120 c.c., 17 per cent; second hour 150 c.c., 9 per cent.

*Blood pressure*—172/102.

*Urine examination on admission*—

| Amt. | Char. | Reaction | Sp. Gr. | Alb. | Sugar | Microscopic |
|---|---|---|---|---|---|---|
| q.s. | clear | acid | 1014 | trace | 0 | an occasional hyaline cast. |

*Urine examination of cystoscopic specimen*—

| | left | right |
|---|---|---|
| urea | 18 mg. | 22 mg. |
| microscopic | many red blood cells and an occasional hyaline cast. | a few red blood cells |
| Guaiac | 1 plus | negative |

CASE 11.—S. J., aged forty-five, married 26 years, six children; still menstruating, torn badly at confinements.

*Examination*—Large cystoceles, moderate rectocele. Cervix bilaterally lacerated. Uterus retroposed.

*Cystoscopic examination*—Clear urine from both ureters. Catheterized without obstruction. No ureter orifice changes. Capacity of left pelvis 5 c.c., right pelvis 18 c.c.

*Diagnosis*—Moderate hydronephrosis of right side.

## SUMMARY AND CONCLUSIONS

Of the ten cases of prolapse, six were complete procidentias with large cystoceles and four were partially prolapsed. The cervix in these four cases was markedly hypertrophied and elongated, as was the portion of the uterus that protruded through the introitus. Eight of the cases had hydroureter and hydronephrosis. In two the urologic examination failed to show any abnormality. It is interesting to note that these were partial prolapses, one of which was accompanied by a large cystocele and the other by a moderate sized cystocele. There were four cases of bilateral hydronephrosis, and the other four had only one sided lesion. In general the complete prolapses were associated with large cystocele and showed the bilateral kidney-ureter dilatation. In one case (Case 10), that of an elderly nullipara with a slight cystocele, the dilatation of the renal pelves was bilateral, but of a moderate degree. In one other case (Case 11), that of a large cystocele and no prolapse, there was a moderate unilateral hydronephrosis showing that the dislocation of the bladder itself produces ureteral stasis and dilatation.

Pessaries were worn by only three of these patients. In one of these there was a unilateral hydronephrosis; in another, a moderate bilateral hydronephrosis. This patient had done without the pessary for eight months preceding the examination. In the third case no dilatation was found although the patient wore the pessary at irregular intervals.

In general it may be said that the older the patient and the longer the duration of the prolapse, the more likely will the dilatation of the kidney pelves and ureters be associated with it. From the large percentage of hydroureter and hydronephrosis encountered in the cases of prolapse of the uterus with cystocele, (80 per cent) of the cases forming the basis of our study it is fair to conclude that there is an important etiologic relationship between the two conditions. When taken together with the high incidence, 15 hydroureters in 23 autopsies reported by Tandler and Halban, there can be no question as to the secondary effects produced upon the kidneys by long standing uterine prolapse.

It becomes at once clear that the need for early operations to correct descensus and genital prolapse must be recognized. Pessaries in inoperable cases offer relief of the prolapse itself and also save the kidneys from secondary damage.

In advanced, neglected cases it becomes all the more important to take measures to study and conserve kidney function before undertaking operative correction of the prolapse. Greater attention to phenolsulphonephthalein and indigo carmine output, to extent of the blood for nitrogen retention, etc., may indicate the extent of

kidney damage entailed by these women with genital prolapse. Simple testing of the capacity of the renal pelvis and ureter by the use of sterile water alone will be sufficient to determine the degree of ureteral dilatation. The injection of sodium iodide or of sodium bromide in solution will be reserved for doubtful cases, and one ureter will be adequate for the demonstration.

Finally, it may be well, when undertaking established operations for the cure of uterine prolapse or in planning newer methods, to consider the relief of the ureter and kidney dilatation. Postoperative urologic examination will ultimately indicate the best procedure to be adopted in these cases. At the present time it may be stated that ventro-suspension along with the vaginal plastics would meet these requirements. Care should be taken however to avoid too high elevation of the uterus.

Inasmuch as the cystocele plays an important part in the production of the ureter dilatation it is clearly an indication for early operative correction.

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## THE TOXEMIAS OF PREGNANCY VIEWED FROM THE STANDPOINT OF CHRONIC SEPSIS AS THE ETIOLOGICAL FACTOR

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OBSERVATIONS made during the last two years which tend to show that the placental infarct is the result of hematogenous infection of the placental site have, I believe, illuminated this much discussed subject, the etiology of the toxemias of pregnancy. These observations have been set forth in three papers[1] of which the following summary may be made.

1. The white placental infarct is the end-result of a hemorrhagic lesion, its evolution being described as a coagulation necrosis.

2. The lesion is a discrete process, often multiple and often repeated in the same placenta.

3. The placental lesion is secondary to a hemorrhagic lesion in the maternal blood vessels of the placental site.

4. There is clinical and histological evidence that the primary lesion in the maternal blood vessels of the placental site is infectious in origin.

5. The clinical sequence of events observed shows that the lesion

is the result of hematogenous infection and that the source of the infection is generally to be found in the teeth and tonsils.

6. By the determination of the infectious origin of placental infarcts, a large clinical entity is demonstrated in pregnancy which has chronic sepsis as its initial lesion.

In these papers it has been the endeavor of the writer to show not only that the placental infarct is the result of hematogenous infection of the placental site, but also that much of the pathology of the products of pregnancy which is so frequently found in association with toxemia of pregnancy is in reality dependent on this principle of hematogenous infection of the placental site. In this paper it is to be my endeavor to draw a conception of the process by which hematogenous infection from foci of chronic sepsis produces the symptoms which go to make up the disease entity, known as toxemia of pregnancy with or without convulsions.

Although the writer is well aware that many of the ideas advanced are unsupported by laboratory evidence, nevertheless he is so convinced of the principle of hematogenous infection as the source of most of the infarcts of the placenta that he feels that he is justified in advancing the following conception and supporting it by the application of this important principle and by analogies from other disease complexes.

The process involved in producing a new individual is the most severe physiological function test which the human system has to endure. Every metabolic organ is called into play in pregnancy. This call is necessarily in addition to the ordinary demand on those organs which have to do with maintaining the life of the individual. The demand of the growing fetus may be considered a great mobilizer of every organ which has to do with supplying those chemical compounds which go to the building of the new individual. The whole system of the woman is therefore undergoing a constantly increasing strain until the fetus is mature and thrown off.

By what process is this demand carried to every organ of the maternal system? The answer to this question raises the mooted point as to whether the metabolic changes in the body are purely the result of specific hormones or whether the sympathetic nerve system plays an important part. It is suggested that the advent of the waste products of the proliferating ovum into the blood stream of the maternal organism may throw out of balance a state of equilibrium between the waste products and the products for anabolism in the blood stream of the mother. This excess of waste products may thus act as a call upon the system to increase its anabolic processes to maintain equilibrium. It is equally probable that these by-products of the ovum may have a specific character and be true hormones. It is however unreasonable to neglect that great silent system of

sympathetic nerve fibers in our conception of the many metabolic balances between organs which we know must exist. It is my conception that this vast nerve system has as its primary function the corollation of the functions of the many metabolic organs and that the blood stream is not merely a mass of chemicals and catalyzers without the assistance of the sympathetic system in maintaining equilibrium in the functions of the many organs of the body. This view has been supported by recent investigation[2] which shows that certain glands of internal secretion are under the control of the sympathetic nerve fibers. It is also an accepted fact that smooth muscle is under the control of the sympathetic nerve system.

Instead of the usual balance between the anabolic and katabolic processes of the body, the system is stimulated in pregnancy so that the anabolic processes must exceed the katabolic processes, the increasing size of the fetus causing a gradually increasing demand or strain upon these anabolic processes and this strain is in part borne by the sympathetic nerve system in its function of corollating the functions of the separate organs.

Side by side with this process goes the increased strain on the excretory organs of the body necessitated by the need of carrying off the increase in waste products resulting from this general increase in the metabolic rate within the body. Some of this strain required by the necessary corollation between the metabolic and excretory functions of the body must be borne in part by the sympathetic system.

It is this increase in the activity of the somatic nerve stimuli passing over the sympathetic nerve system as the result of a normal pregnancy which I wish to bring clearly to the mind of the reader. The tone of the whole sympathetic system is raised above its normal level.

It does not seem necessary to enumerate in detail the symptoms of toxemia of pregnancy. It is important to emphasize the point however that these symptoms are not confined to the pregnant state. It has been, I believe, truthfully stated that there are no symptoms of chronic nephritis which do not appear in the syndrome of toxemia of pregnancy. This fact seems to warrant the drawing of a very careful line between the symptoms of the patient as a result of the toxemia, and the pathology of the pregnancy itself which is found in association with the toxemia. As has been stated above much of the pathology of the pregnancy itself can be attributed to infection of the placental site.

The frequency with which placental infarcts of infectious origin appear in placentas tends to show that bacteria pass in the blood stream of the individual much more frequently than has hitherto been supposed. This must mean that not only the placenta but other organs

and tissues of the body are likewise attacked by these emboli of bacteria.

That these other tissues do not show evidence of damage as often as the placenta can be explained. The conditions in the placental site are especially favorable for the lodgment and activity of the emboli which for the most part are made up of bacteria of a very low grade of virulence. In the first place the placenta and the placental site is a region undergoing rapid proliferation of tissue. In all proliferating tissue there must be a large number of trabeculated capillaries which would act as meshes for catching these emboli and giving them opportunity to enter the tissues. Since the edge of the placenta is the site of the most rapid proliferation, this accounts for the observation that the edge of the placenta is the part most frequently infarcted.

In the second place a newly produced tissue in all probability has not as high a resistance to the invasion of bacteria as the other tissues of the body. Without doubt many of these emboli of low grade bacteria do lodge in the other tissues of the body but on account of Nature's defensive processes they produce little or no disturbance. This phase of the problem involves the kind of bacteria, their virulence and the resistance of the tissues attacked. It is when these factors are out of balance that we find damage in other organs of the body.

Is this conception of single bacterial embolus or showers of bacterial emboli from foci of chronic sepsis applicable to the known pathology of toxemia of pregnancy and eclampsia?

The recent review of the pathology of toxemia of pregnancy by Kosmak[3] is most illuminating in this connection. He shows that the characteristic lesions in many different organs are minute hemorrhages. The following quotations are in point: "Eclampsia, characterized by focal cell degeneration and necrosis, as a result of thrombosis of the smaller vessels (of the liver) is represented by eclampsia with or without convulsions. *Subcapsular hemorrhages are common.*"

In regard to the kidney, "In eclampsia the kidney is not diminished in size, (an acute process), the appearance is anemic, (due to edema), the cortex is cloudy and in many instances (not constant because of the different stages in which they are examined) presents *small punctate ecchymoses.*" (The explanatory words in the brackets are my own.) "The capillary vessels show stasis and may contain actual thrombi." "Infarcts are present and are due to the migration of emboli from other organs." "Renal changes were found by Polak in 98 per cent of 139 autopsies of eclampsia."

"Although kidneys and liver present the most frequent and most characteristic pathological changes at autopsy, almost all the organs may be more or less involved. *Hemorrhages* may take place into the

lungs, and pleura, pericardium, cranial cavity and brain, gastric mucosa, peritoneum and skin."

How similar are these multiple hemorrhagic lesions to those in the blood vessels of the placental site. How similar the conditions may be said to be to those in miliary tuberculosis which represents a shower of tubercle bacilli into the blood stream as distinguished from a few embolic processes which result in a single tubercular kidney or other discrete lesion.

Acceptance of this conception explains the finding that red infarcts, in other words the acute or fresh infarcts, are most commonly associated with an acute nephritic condition in the patient. These fresh lesions in the placenta and kidney may be both simultaneous results from a shower of bacterial emboli from some common focus elsewhere in the body.

Kosmak also states, "that bronchopneumonia and extensive pulmonary edema are often found in cases progressing to a fatal ending several days after convulsions have ceased." In this connection it must be remembered that all hematogenous infections enter the blood stream on the venous side and must pass through the lungs before they are scattered about the body.

"*Hemorrhagic lesions in the brain* have been noted in most autopsies in eclamptic subjects, both substance and cortex being involved."

It must be remembered that the pathologic findings here reported are all the result of an infection sufficiently virulent and sufficiently general to cause death. All grades of these findings of lesser intensity are undoubtedly present in those individuals who recover from the disease. Thus the process grades off to the single infarct in the placenta, to the attack of pyelitis, to the breast abscess or the threatened breast abscess.

With our present knowledge of the different kinds of bacteria involved in areas of chronic infection, their graded virulence and the wide variation in resistance to bacterial invasion of different individuals and different tissues, does not this conception offer a picture entirely in harmony with the rest of our knowledge of infectious disease? Is not the picture of the pathology of the disease rendered less confusing, in fact, is it not unified when we consider the simple character of the lesion, a hemorrhagic lesion in both the placental site and the other organs of the body and the single character of the means by which it is scattered about the body, the principle of hematogenous infection? Is not the picture of a hemorrhagic purpura, or a miliary tuberculosis exactly similar as to principle?

Not only is the pathology consistent with the conception that the disease is a systemic infection but also the clinical picture is more than merely suggestive. Most all eclamptics who die have a con-

siderable degree of fever. Kellogg[4] has also recently shown that toxemics are very prone to sepsis (as shown by an elevated temperature). He states that 2.5 per cent of non-toxemics unselected became septic, 14 per cent of toxemics without convulsions became septic, 25 per cent of toxemics with convulsions became septic, *irrespective of the method of delivery.* These figures show plainly the graded potency of the infection present in the system.

With this picture of the multiple spotting of bacteria throughout the system sometimes as a single embolus, sometimes as a shower of emboli, is it any wonder that the corollation of the functions of the different metabolic organs becomes upset? If the liver or the kidney becomes the seat of many minute hemorrhagic lesions their function must certainly be disturbed at least temporarily. In addition to the load of producing a new individual there is therefore the load of fighting an attack from the invading bacteria.

It is well known that an acute infection will sometimes precipitate a toxemia of pregnancy. This is not the result of the damage which this infection causes to the placenta but of the upsetting and overloading of the metabolic system which is already under stress. If however this acute infection subsides and the resistance of the system is sufficient to overcome the attack, nothing but a temporary disturbance results. If this so-called acute infection is in reality an acute exacerbation of a chronic process and the repetition of emboli continues from the chronic focus, it is under such a set of circumstances that the acute infection may be the precipitating cause of a slow or rapid toxemia.

It is this conception of the processes involved that makes me believe that toxemia of pregnancy is almost never the result of a single acute infection of short duration. It is the long standing infection with its often repeated emboli of bacteria which repeatedly disturbs the metabolic balance necessitating greater and greater effort on the part of the system to compete with the constantly ascending strain upon which it is placed.

The end result of all this stress is reflected in an increased tone in the sympathetic nerve system. Smooth muscle throughout the body receives its share of the increase of nerve stimulation and its tonus is raised. This is reflected by the rise in blood pressure and tendency to constipation. A condition of increased tone or spasticity results in the smooth muscles surrounding the arterioles and the intestine. This hyperstimulated condition is further reflected by the fact that the patient is often nervous in the sense of having a sensation of tension with no definitely localized symptoms. Sleep is often difficult to obtain, is fitful and not as restful as usual. In this connection it should be borne in mind that the adrenal gland, whose secretion we know

affects the blood pressure, is embryologically and functionally in the closest association with the sympathetic nerve system.[5]

As the demand of the pregnancy gradually increases, these repeated stimulations result in many minor discomforts. The sympathetic nerve system is in a situation similar to that of a motor neuron receiving a subminimal stimuli which, when summation is reached, results in a contraction of the muscle under its control. In other words the stimulated condition of the sympathetic system reaches the threshold of the synapse which separates it from the motor and sensory nerve system. Cramps in various muscles may be suggested as minor evidences of this condition. Twitching sensations and paresthesias also fall into this class of minor symptoms. When the strain on the system becomes profound with high blood pressure plus the damage to the liver and kidneys resulting in inefficient elimination, then the synapse threshold of the brain cells is finally crossed with the resulting motor activity characteristic of the convulsion. Epigastric pain, the forerunner of the convulsive state, is probably the result of the crossing of these somatic stimuli into the sensory tracts. Not infrequently labor is ushered in. Each of these features may be attributed to the hyperstimulation of the sympathetic nerve system. (Headaches will be dealt with in greater detail a little later.)

We often find that when a patient in this hypersensitive preeclamptic state receives external stimulation such as is necessary in bringing the patient to the hospital, or in examining her on admission, or in the necessary handling in the process of getting treatment started, this external stimulation is enough to overload the synapse threshold and a convulsion results.

During the process the end result of which is marked by this well-known cataclysm of nerve stimuli, the convulsive state, there has been in most cases the gradual rise of blood pressure. As has been suggested this sign is the result of an increased tone in the smooth muscles surrounding the arterioles and their capillaries due to hyperstimulation of the sympathetic nerve system. It is generally conceded that this process is one of Nature's protective processes resulting in increased elimination. Under normal conditions the reserve power of the eliminative system is sufficient to handle the situation. As long as metabolic equilibrium is maintained, all goes well. Should, however, the detoxifying function of the liver or the function of the kidney be sufficiently injured or reduced by a bacterial embolus or emboli, then the system is forced to call upon the increase of blood pressure to bring about the required increase in rate of elimination. All goes well in the case as long as the increase in blood pressure competes with the increased demand for elimination. Many cases present this sign of toxemia of pregnancy alone. It is my conception

that these cases represent the successful attempt on the part of the system to cope with the demand.

As soon as the kidney begins to show albumen in the urine however we have evidence of a profound disturbance of the kidney as an organ of elimination. Disturbance in elimination may be present long before albumen is found in the urine but this sign is a positive sign of danger regardless of the height of blood pressure.

Disturbance of the eliminating functions of the body is of the most serious import in such a situation as it necessitates a further strain or readjustment of the whole system. Retention of waste products must interfere with proper metabolic interchanges and retention of water increases the bulk of the blood stream.

The increase in the bulk of the blood stream by the retention of water necessitates a dilatation of the whole blood system. As the process progresses we have an increasing force applied from within the arterioles counteracting the stimuli from the sympathetic nerves which are endeavoring to contract the arterioles to raise the blood pressure and thus increase elimination. Gradually through the actions of these opposing forces a state of fatigue in the smooth muscle coats of the arterioles results which takes place first in those dependent portions of the body where the strain is the greatest. Edema or the passage of an excess of fluid to the tissues through the thinned out dilated capillaries is the result. Pressure edema or cardiac edema falls readily into this conception.

Edema may also come in localized regions from paralysis or partial failure of nerve function due to other causes, such as the action of the toxins of bacteria on the sympathetic nerve fibers themselves. Witness the paralysis of the intestine in association with general peritonitis.

In general severe acute infections have a lowered blood pressure as a rule. It is probable that the lowering of the blood pressure under this condition is due to this relative inefficiency or partial paralysis of the sympathetic nerve fibers in control of the peripheral circulation resulting from the severity of the acute infective process or the action of bacterial toxins on the sympathetic nerve fibers.

This conception of the cause of edema, is, I believe, supported by well-known phenomenon in arteriosclerotic type of chronic nephritis. Edema is much more rare in this type of case than in the earlier parenchymous type of chronic nephritis. If we recognize the fact that the arteriosclerotic process involves the peripheral circulatory capillaries as well as the larger vessels, it will be seen that their elasticity has been at least partially lost and although the blood pressure may attain considerable elevation through the reflex call on the heart for greater elimination, yet these calcified arterioles do not dilate to allow the diffusion of fluid to pass into the tissues. Fracture of these

arterioles from internal pressure is a feature of this type of chronic nephritis.

Undoubtedly the local paralyzing effect of the toxins of bacterial activity plays an important rôle in the disturbance of function of those organs attacked by the minute bacterial emboli which we have seen are passing here and there in the body. Localized edema is present in nearly all acute infective processes. Edema of the brain so frequently found in the dead eclamptic may be due to either the passive or the active causes described but in this connection it is important to bear in mind the statement by Kosmak that hemorrhagic lesions in the brain have been noted in most autopsies on eclamptic subjects. These lesions represent the invasion of the brain tissue by the bacterial emboli. The edema may well be due to the toxins coming from these foci.

It has been hoped by many that the amount of retained nitrogen in the blood stream would give a measure of the toxemia present. Examinations of the blood of toxic and eclamptic patients have shown that this hope has failed. In general however most investigators have shown that there is some degree of retention in this class of cases. This finding is consistent with the conception of the disease process which I have advanced. This retention of waste products is not in itself the cause of the phenomena of the disease but is merely an associated phenomenon. The real cause of the disease is the disturbance of balance of the functions of the many organs involved, reflected through the hyperstimulation of the sympathetic system to correct this disturbance. Thus, disturbance of the functions of such an important organ as the liver may precipitate eclampsia before sufficient time has elapsed for retention to take place.

Postpartum eclampsia is the most difficult feature to fit into most of the other theories of the cause of this disease. It has been this feature that has convinced me that the cause of the disease is not to be found in the products of pregnancy. If we apply the principle above stated that convulsions are the result of hyperstimulation of the sympathetic nerve system due to derangement of the metabolic functions resulting from the spotting of bacterial emboli through the different organs, it will be seen that the absence of such a feature as postpartum convulsions in this conception of the disease would carry serious doubt as to the validity of the theory advanced.

Not only is it reasonable that a shower of emboli might come from an area of chronic sepsis during or just after labor but also there is a much more potent factor to cause a shower of emboli during or just after labor. If for instance there are several foci of virulent infection in the placental site, (beginning infarcts) just before labor begins, the contractions of the uterus are all that is necessary to spread such infection into the blood stream of the mother plus the trauma to the placental site resulting from the detachment of the

placenta. Thus the infection of the placental site may act as a secondary focus in such a case, and it is probable that it does so act in other situations during the pregnancy.

There is much evidence available that there are numerous cases of vomiting of pregnancy which are dependent on the activity of foci of infection. The pathology of those cases which die show a similarity in the focal lesions in both liver and kidneys. De Lee[6] speaks of a "diffuse *hemorrhagic* hepatitis and extensive areas of necrosis." Also that "the kidney suffers all the changes from those of the so-called kidney of pregnancy to an acute parenchymatous nephritis." "*Hemorrhages* are often found." "The heart undergoes fatty degeneration in the bad cases, *as in sepsis.*" Clinically there is this to be said. Many cases cease to vomit after foci of infection have been removed. This has been borne out not only in my own experience but by the experience of Loomis[7] of California and Rowley[8] of the Mayo Clinic. Some very startling cases have passed under my observation. It has also been true in my experience that those cases which presented no foci of chronic sepsis have in each case been free from any vomiting. It is also true that many cases which have foci of chronic sepsis go along without any vomiting, toxemia or other pathology but I believe it will be granted by all open minded readers that this evidence does not invalidate the theory advanced.

The recent work which has shown that the glycogen content of the liver is much reduced in toxemia of pregnancy and eclampsia is entirely consistent with this conception of the processes involved in producing the disease.

Kendall[9] in his book on bacteriology states that pathogenic bacteria, if given an opportunity of choice between carbohydrate food and protein food, will universally attack the carbohydrate food first. A similar early utilization of carbohydrate stored energy is apparent in the metabolism of the human body. He also points out that the toxins of these pathogenic bacteria are much less virulent when they are fed upon carbohydrates. I believe the application of these two general principles will explain the findings that the liver is impoverished of its glycogen content in toxemia of pregnancy.

As a fundamental feature there must be a rapidly increasing demand on the part of the growing fetus for the simpler forms of carbohydrate food. In toxemia of pregnancy we have in addition a systemic attack by bacteria. The virulence of these bacteria can be modified if the body fluids can be enriched by carbohydrates. Therefore the system increases its call upon the store of glycogen in the body. It is, I believe, an accepted finding that the percentage of blood sugar is slightly above normal in the presence of most acute infections. Consider this process in the light that we have, which shows that the liver itself is limited in its functions of producing and storing glyco-

gen by the direct attack of these bacteria. The end result is found in the reduction of glycogen in the liver brought about by the increased demand of the pregnancy plus the systemic infection and the interference with the reproductive process by damage to the liver. It is the extra load or demand which the pregnancy exerts in this situation which precipitates symptoms which do not appear in other infections. Thus the feeding of the simpler types of sugars is of assistance in the battle against this disease process.

Many cases of toxemia respond to eliminative treatment and more do not. It is my impression that eliminative treatment merely holds the process in check by relieving one portion of the load. By stimulating activity in the smooth muscles of the intestine the condition of spasticity and resulting constipation is relieved. The demand to bring about sufficient elimination to re-establish equilibrium in the body is the source of the great stress on the sympathetic nerve system and this stress is reflected by the rise in blood pressure. Elimination by the bowels and the kidneys reduces this strain and its indicator, the blood pressure falls. The cause of the disease is however still present and gradually the symptoms return unless the pregnancy is terminated by natural or artificial means.

The beneficial results obtained from the use of morphine in this disease are easily explained by this conception of the hyperstimulation of the sympathetic nerve system. The action of morphine on the sympathetic nerve system is plain. It checks the bowels, slows and often stops labor and checks the secretion of glands. This evidence shows its effect on the somatic nerve system. Veratron acts similarly, only more powerfully, applying its paralyzing action to the sympathetic nerve endings in connection with smooth muscle. The blood pressure is reduced by dilatation of the peripheral circulation which in turn reduces the pulse rate by reducing the work on the heart. The effect of these two drugs tends to relieve the strain on the sympathetic nerve system but as the effect of the drug cannot be controlled or tempered, the treatment may undo nature's protective process for increased elimination by the kidneys. Both of these drugs have important use in preventing convulsions but, as they tend to impede Nature's process of defence, they should not be used except in extreme conditions and over a relatively short time.

Blood-letting by reducing the volume in the blood vessels temporarily reduces the blood pressure. The removal of this amount of force from within the arterioles reduces the amount of required stimulation of the smooth muscle coats to counteract this force. Thus a reduction in the total stimulation upon the sympathetic system as a whole is brought about. A valuable amount of elimination is also accomplished.

Many of the symptoms associated with toxemia may be attributed

to the proximity of the foci of infection themselves. Neuralgias of all sorts are common but the great majority are in the head and neck.

Headache is a very common and very important symptom in this disease. A discriminating study of this symptom shows however that there are many kinds of headache. The one-sided headache is generally neuralgic in type and due to the activity of some focus of chronic sepsis on the same side of the head. As warnings of approaching convulsions they are seldom of any significance. As a leader in the search for chronic infection, they are of the utmost importance as they generally indicate the side of the head where the active focus lies.

The generalized, throbbing, severe type of headache is most often associated with the severer grades of toxemia and is often a forerunner of the convulsive state. They may be interpreted as due to an increase in intracranial pressure due either to high blood pressure or edema of the brain with which they are frequently associated.

There is a third type of headache which may be termed occipital. This type is often associated with stiffness in the muscles of the neck. Not infrequently the stiffness of the muscles is unassociated with headache and is described as a drawing sensation.

This type of headache is, I believe, the most reliable symptom of the presence of chronic sepsis in the teeth or tonsils which we have. Its reliability is of equal value whether the patient is pregnant or not. I speak thus positively because in my experience this symptom has been repeatedly cured by the removal of all foci of infection. It is an extremely common symptom and I have never seen it fail as a leader in dealing with the problem of the presence or absence of foci of infection in the head. An explanation of the mechanism of its production is given in one of my recent papers.

Just as in appendicitis the pain which is felt is a referred pain, so in the head the neuralgia, the one-sided headache and the occipital headache is a referred pain. In both cases the primary stimulation of the nervous system is through the sympathetic fibers adjacent to the infection. The synapse in the former case is probably in the cord, in the latter case it is probably in one of the many ganglia associated with this region.

Is it not possible that the picture which the placenta displays to us, showing the presence of multiple and repeated emboli of bacteria in the blood stream of the pregnant woman during the nine months of its existence, is in reality the method of the systemic attack which results from all foci of chronic infection? Given the point of entrance within the tissues, the damage to the organ or organs which are attacked depends upon, first, the chance that the emboli of bacteria gain entrance to the tissues of the organ, second, that the bacteria have the ability to utilize this particular tissue as food for its con-

tinued life. It is very evident that certain bacteria grow more readily in some tissues than in others. Thus the pneumococcus finds proper food material in the lungs, the diphtheria bacilli in the throat. Typhoid bacilli, although present in the form of a bacteriemia at first, find Peyer's patches and the spleen their most suitable feeding places. Other kinds of bacteria have a wider range of tissues in which to find suitable food but all are subject to one general principle, the resistance of the tissues involved or the power of self-preservation as between one kind of cell which is antagonistic to the life of the other.

Cytolysis adjacent to the invading bacteria is one of the primary events resulting from the invasion of a tissue by the bacteria. This process may be slow or rapid according to the kind and virulence of the bacteria involved. When rapid, may it not be that this cytolytic process causes the minute hemorrhagic lesion by rupturing the adjacent capillaries? Nature's answer to such an attack is through its power to thrombose the blood at the point of rupture of the blood vessel. The cutting off of the blood supply locally by the thrombosis leads eventually to the small areas of necrosis distal to the infective lesion. The effect on the system is shown only when this process is wide spread and damaging enough to reduce the function of the injured organ or organs and thus to disarrange the balance between the many organs of metabolism.

It is the conception of the writer that the processes involved in the production of the disease of toxemia of pregnancy are the same processes which are involved in the production of all infectious diseases. In pregnancy we have a condition in which the potential power of the whole metabolic system is placed on a strain. Under this strain derangement of the necessary balance between the organs of metabolism is more readily reflected and we find symptoms which are more commonly found only in the late results of more chronic disease processes such as chronic nephritis. An acute general infection such as a pneumonia in the presence of a pregnancy does not produce the symptoms of toxemia of pregnancy because its effects on the system are not brought about by the spotting of bacterial emboli so much as by a toxemia which is sufficiently severe and general to partially inhibit or paralyze the sympathetic nerve system as a whole.

In conclusion the author wishes to point out that the principles involved in the foregoing conception of the cause of toxemia of pregnancy are sufficiently broad to embrace the many different types of toxemia which are apparent in the disease and yet are sufficiently specific to explain those variations. In the many different theories which have been advanced each author has advanced his theory based on the preponderance of evidence which was apparent in his

series of cases. Thus the kidney theory has been qualified by the liver theory. Intestinal auto-intoxication has been thought to be the cause. Disturbed metabolism has had many devotees. Because of the frequent association of pathology in the products of the pregnancy the cause of the disease is believed by many to come from the fetus or the placenta. None of these explanations has been broad enough to account for all cases. It is the belief of the author that the preceding conception shows how the kidney or the liver may be the most prominent feature of the case. It shows why constipation is usually associated with the disease. Disturbed metabolism, although not always apparent in the blood chemistry, is reflected in the hyperstimulation of the sympathetic nerve system. The pathology of the products of conception is explained as damage resulting from hematogenous infection of the placental site. It shows that Young's theory which lays the cause to the products of infarct formation is true only in the sense that the acute infarct may act as a secondary focus for the spread of infection and may be contemporaneous in its origin to the damage of similar nature in other organs of the body, this latter damage being the true cause of the symptoms of the disease.

It is further emphasized that the fundamental principles upon which this conception is based are equally applicable to other infectious complexes.

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28 PLEASANT STREET.

# THE INDICATIONS FOR AND THE VALUE OF TUBAL PATENCY TESTS IN THE STUDY OF STERILITY*

By Wm. H. Cary, M.D., F.A.C.S., Brooklyn, N. Y.

THERE seems to be a definite need, and the time seems appropriate, to appraise the value of tubal patency tests in the study of sterility.

Such an appraisal involves a consideration of the indications for testing the patency of the fallopian tubes. It includes also a study of the importance such tests may be accorded as demonstrating the ability of the tube to provide a union of spermatazon and ovum. It includes also the enumeration of the contraindications. Under the latter heading we must elaborate the important question if there be not instances when for sociologic and domestic reasons it may be unwise to carry our investigation to a definite proof of damaged tubes.

It was my pleasure to present in 1914,[1] for the first time I believe, a plan and technic of studying tubal patency by demonstrating by x-ray the escape into the abdominal cavity of a registering fluid injected by the transuterine route. The value of the procedure was at once recognized and taken up by others, and case reports and x-ray pictures followed. I regret to say that recognition of the source from which the idea emanated was not always clear. I have not alluded to this previously in a formal way for I have the greatest distaste for discussions of priority. It is not important, and the facts are definitely established in medical literature. While others were elaborating and materially modifying and improving† the technic, with other names taking prominence until the child would not have recognized its own father, I had already begun to seek a simpler and cheaper method for testing tubal patency. This, in a measure, answers the criticism which has been made because of my failure to report cases, etc., in my first paper. In further explanation, one must remember, that as early as 1914 x-ray technic lacked much of its present development. The institution with which I was affiliated had insufficient apparatus or money to carry out this experimental work. The patients whom we studied were taken to a private laboratory, and unfortunately I did not have the finances to continue this expensive work. While others rapidly developed this original principle, I abandoned experimental work along these lines and, as stated above, developed a much more simple method and one of equal accuracy, though of less definite demonstration. This method[2] I presented in a paper on sterility

*Read at a Meeting of the Section on Obstetrics and Gynecology of the New York Academy of Medicine, May 22, 1923.

†Notably the excellent work of Rubin.

diagnosis in 1921 before the New York Obstetrical Society. I did, however, hope for, and would have welcomed sterility cases, justifying the expense of tube study, but I was interested to find that as I studied my sterility cases more thoroughly the need of patency study proportionately diminished. I have never deviated from a principle then enunciated that the indications for studying tubal patency will diminish in ratio to the completeness with which the sterility problems are otherwise studied.

I wish to emphasize that I am interested in the general study of sterility, and consider it one of the most difficult and important branches of medical work, and I resent any impression that the question of fertility is solved by one's ability to force some substance through the tubes. I wish to reiterate that investigating the patency of the tubes by any of the tests is a very small part indeed of the work one must be prepared to do in studying sterility. I would further emphasize that I have found that tube patency tests are very rarely necessary but when indicated they are, of course, of the utmost value.

If my observations are correct, we may define the indications for studying tubal patency as follows: *When by competent study, the fertility of the male is established and by the insemination test successful migration of spermatozoa to the fundus of the uterus is demonstrated, thus fixing responsibility upon the adnexa by a process of exclusion, the patency of the tubes should be tested, if a blockade of these structures is not already reasonably established by reason of a history of inflammation with confirmatory findings upon bimanual examination.*

Now let us analyze this rule for indications. I think it is generally granted that 50 per cent of the sterility cases coming for study will prove to be of male origin. A small number will show gross pathology definitely explanatory. A very small percentage will be due to destructive chemistry in the vagina, while a much larger number will be shown by the insemination test to have mucus blockade in a chronically diseased or hypersecreting cervix. When, however, all these possibilities are eliminated, the adnexa will be found responsible in a relatively larger number of cases. In my experience, it is surprising how few of these cases require a patency test for diagnosis. Induced abortion with long convalescence in early marriage, a husband acknowledging an uncured or improperly treated Neisser infection, a history of appendicitis with abscess or peritonitis, an earlier curetting with subsequent morbidity, are found lurking in almost every history. With this acknowledged it is surprising how to trained hands the tell-tale findings on bimanual examination complete the diagnosis. A fixation of the ovary, a cervix held up to one side, a tube fixed in the culdesac, or a fixation of soft tissues make the story of tube in-

efficiency definite. Why with a history of years of sterility, definitely shown by elimination to be adnexal, and with the above findings anyone should hesitate to make a diagnosis I cannot understand. Are we going to lose faith in our bimanual examinations just because we have a new technic? I make such diagnoses repeatedly and I tell these patients to put their trust in time, menstrual rest and perfect hygiene, including prevention against reinfection. A laparotomy solely to correct sterility is, in my opinion, rarely justified. I do not expect these patients to accept operative intervention after I have given them an honest statement of the small percentage of successful results. My prognosis is discouraging but not hopeless, and it would not be materially altered just because I succeeded in forcing gas or fluid through the tubes by high pressure. With grosser pathology there could be no excuse for the expense, aside from the possible risk of investigating the tubes. A few cases remain when neither the history nor the

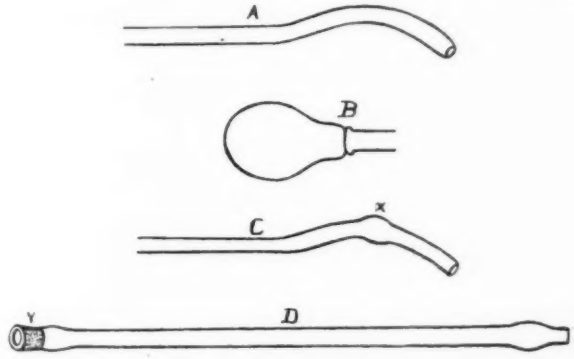


Fig. 1.—Perfected details in technic and equipment are necessary. (*A*) A ten inch pipette (16 F to 18 F) with Skene tip is the standard. (*B*) Rubber bulb must fit absolutely air tight. Any leak destroys accuracy of test. (*C*) Another modification of pipette by author, the expanded bulb (*x*) one inch from the tip assuring absolute fit in the more patulous cervical canal. (*D*) Pipette made for author with Luer syringe connection (*y*) for cleansing tenacious mucus from cervical canal before making saline test. A quick and painless method for cleansing the canal in treating endocervicitis. (Pipettes made by Tiemann & Co.)

dexterity of the examining hand can reveal sealing of the tubes. In these cases the patency tests are of the greatest help. Closed tubes are encountered where no suspicion points. For these examinations my simple pipette (Fig. 1) and saline method, gentle, painless and easily executed, gives me increasing satisfaction. It is surprising how, with practice, the tips of one's fingers on the rubber bulb learn to measure resistance. I believe the less force used the more accurate the knowledge gained as to function. I am not sure that patency in a physical sense constitutes functional patency, and one should be most modest and careful in his conclusions.

Under the heading of indications the treatment of tubal occlusion by injection or inflation may possibly be in order. One's imagination

readily conceives of a tube lightly sealed that could be opened by such technic. I have had reason to think that I accomplished this result with saline injection on three occasions. Such results are not subject to proof. These experiences occurred while the usual diagnostic technic was taking place. If I cared to utilize greater pressure, such experiences might be more frequent. Greater pressure, however, I believe certainly diminishes the value of the technic as a diagnostic measure, for one is seeking to explain the relation of the tube to the failure of impregnation. My impression that tubes open under pressure was gained by accidental occurrences, and are not observations made while injection was done as a means of treatment. In a previous paper I suggested that such technic offered a possible therapeutic measure but I have had insufficient experience to make any report. I have no series of cases. Conscientious adherence to the principle which I have already stated limits one to a few cases. I am working at present on a patient with an absolute sterility of seven years, with all other conditions for pregnancy perfect except sealed tubes, doubtless due to an appendicitis with abcess which occurred the year of established puberty. The process has now been quiescent for thirteen years. My tendency is to select one case of proper indications and study it as intensively as possible. The results of such study may not be spectacular, but the information obtained is of real value. In this case I have injected the tubes only once a month after the cessation of the period and before coitus has occurred, thus escaping any possibility of interrupting a pregnancy. This latter possibility is one that must be kept in mind. Wholesale use of this technic will certainly produce some early abortions—a veritable calamity in this class of cases. Ectopic pregnancy is another possibility. I have charged myself with one. The patient referred to above has accepted this risk, frankly explained. Extreme conservatism is felt by the writer, and attempting to open damaged fallopian tubes by pressure exerted through the uterine route should be restricted to expert workers.

Another indication is emphasized by Stone who states that he has for some years used transuterine injection of fluids before laparotomy in certain cases to demonstrate the condition of the tubes.

### CONTRAINDICATIONS

A detailed consideration of the contraindications is not necessary, for the negative phase of our subject is defined by restrictions outlined in our definition of indications. Cases with infection of the cervix, definite adnexal inflammatory lesions, etc., are at once excluded.

There is, however, a very small class of patients where the surgical indications may be quite satisfactory but for whom we may, for soci-

ologic reasons, hesitate to utilize all our methods of diagnosis. Genito-urinary specialists learn to recognize a type of patient to whom they do not make a hopeless prognosis of sterility. Depression, mental unbalance and suicide have followed a casual hopeless prognosis. The most satisfactory domestic relation may be strained to the utmost by the consideration of fertility. Every gynecologist will also encounter patients where a definite diagnosis of tube blockade will not be practicable. One of the modern products is a woman informed, but not too well, on social diseases who interprets disease of the tubes as evidence of hopeless sterility. Furthermore, there is the conviction, often aggravated by the physician's denial of the responsibility being the husband's. I avoid or cautiously proceed with diagnostic measures when I feel I am handling a patient of this type, the one of strong maternal instinct, on trouble bent, seeking the cause of her childlessness. A bitter and depressed patient, ill-disposed toward her husband and home, is not a happy ending to a scientific triumph. This hint is applicable to the whole question of sterility.

In conclusion, I would reiterate that I am interested in the whole subject of sterility, a subject of infinite scope. Evolution is constantly in progress. The biologist and scientist are presenting new and pertinent facts daily. If cell activity is due to electron unbalance, who can measure the influence yet unknown? Men with big clinics will ultimately call associates in kindred sciences to aid in sterility study, and here I predict will be one of the great future advances in medicine. I have recited the early history of tubal patency work to show that if my opinion of the importance of tubal patency tests to the subject of sterility seems overly conservative and is ultimately shown to be ill-founded, it will at least carry the evidence of sincerity.

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36 PIERREPONT STREET.

# THE PHYSIOLOGICAL LOSS OF WEIGHT IN THE NEWBORN AND ITS CONTROL*

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THE physiological loss of weight occurring in the newborn was first accurately described by Chaussier[1] in the latter part of the 18th century. Quetelet, in 1838 confirmed his observations and was the first to chart the weight curve of a normal breast fed infant.

In the thousands of statistics available, it is the exception to find that this loss of weight does not occur.[2] Its symptomless progress, and the prompt return to the initial weight when sufficient and proper nourishment is assimilated, justifies the assumption that this phenomenon is a physiological one.

The weight loss as reported by many authorities is approximately 6 ounces in the first 24 hours. This is an average and the limits range between 1 ounce and 20 ounces. During the second 24 hours the average loss is less, about 4 ounces, while during the third 24 hours, there is very little loss or the weight becomes stationary. These weight changes, particularly after the first 24 hours, are dependent chiefly on the amount and character of nourishment which the child obtains, all other factors which tend to inhibit the assimilation of nourishment, chilling, illness, and anatomical defects, being absent.

The physiological loss of weight occurs because the infant excretes more than it assimilates.[3] The amount of meconium averages about 3 ounces.[4] Urine is passed during the first day, although no fluid may be taken by mouth. The amount of urine excreted is mostly dependent upon the relative and absolute water content of the body.[5]

The amount of urine passed during the first 24 hours is about one-half ounce, one and one-half ounces in the second day, and about 3 ounces in the third day.[6]

It has been frequently observed that the newborn infant does not pass urine during the first day. This occurs in about one-third of all newborns.[7] This anuria is to be considered without clinical significance, and is due to the low water content of the tissues, and the starvation to which the infant is subjected in the first day of life.

Among the other channels by which weight loss occurs and of far greater importance is the loss due to the dehydration of the tissues. The loss occurs by way of the skin and lungs.[8]

*Read at a meeting of the Section of Obstetrics and Gynecology, New York Academy of Medicine, May 22, 1922.

Von Reuss[3] very aptly describes the picture of the infant after this dehydration has occurred. "It is only necessary to examine the newborn child during the period of losing weight to perceive that a loss in the body substances which are derived fom the fetal period is not all that takes place. The postpartum tightness of the infantile skin changes * * * so that it becomes flabby and wrinkled." In reality there is a loss of water causing a distinct lessening in volume of the deeper tissues.

The body of the newborn infant is rich in water. It comprises about 70 per cent of the entire weight.[9]

By way of the skin most of the water is lost in the form of what is known as insensible perspiration. The sweat glands do not function in early infancy, and the observations of Loewy[10] have shown that the insensible perspiration is independent of the sweat glands. The work of Soderstrom and DuBois,[11] Sauer and McClure,[12] Benedict, Atwater[13] and others give definite data as to the importance of the insensible perspiration as an avenue of escape for water from the tissues. These observations, however, were confined entirely to adults.

Changes in the serum protein percentage indicating changes in the plasma water,[14, 15, 16] show that as the concentration of serum protein reaches its highest point, the weight loss will have reached its lowest level. As the weight increases there is, in most instances, a fall in concentration of serum protein. In certain instances[16] there may be no change in the water content of the plasma due probably to a large water reserve at birth.

In a study of the respiratory water loss during the period of psysiological weight loss,[17] it was shown that during the first 12 hours with no food intake, there was a respiratory water loss twice as large as the loss sustained by the excretion of urine and meconium. During the second day the child was fed weak milk mixtures entirely inadequate in strength and amount to meet the caloric requirements of the child, nevertheless the respiratory water loss became 5 times as great as the loss by urine and meconium.

These experiments were confined entirely to the estimation of water loss by respiration, and the amount of loss sustained by evaporation from the skin of the newborn has yet to be determined.

The amount of water in the tissues is in direct proportion to the absolute body weight. In those infants weighing less than 5 lbs. at birth, the relative loss is 8-9 per cent of the initial weight. Infants weighing 6-7 lbs. lose about 7 per cent, 7-8 lbs. lose 6 per cent, and those weighing over 8 lbs. lose 5 per cent and less.

The absolute loss of weight in the large child of 8 lbs. and over is usually much greater than that sustained by the smaller infant. In the statistics of Dluski[18] there is shown a loss of 150 gm. in those

infants weighing 1500-2000 gm. and a relative loss of 8 per cent. Infants of 4000-4500 gm. lost averagely 270 gm. and a percentage loss of 6.

There is no proof to show that the tissues of the larger child contain a greater amount of water than is found in the smaller infant. Nevertheless we can assume that this is true by the above, and by our own observations. The larger child sustained in all instances, a greater loss, there being no intake of fluid during the interval of observation.

The large child will regain its initial weight more rapidly. This is due to the fact that usually a multipara will give birth to a larger child, and will have a better and more rapid secretion of breast milk. Further, it is reasonable to assume that in the small infant there is a certain degree of feebleness when compared to the robust child of greater weight. It is not to be assumed that the energy of an infant is dependent upon its weight, but the infant of 5 lbs. and less will show a degree of muscular inertia, and its ability to nurse will be correspondingly feeble.

It is the custom of some to place the infant to the breast directly after birth, and in some instances to complement the breast feedings by weak milk mixtures, whey, lactose solutions or large amounts of colostrum.[19] Sadowfsky and Gundobin[3] by placing children to the breast 12 times in the first 24 hours, and later 2 hour interval feedings by day and 4 hour interval feedings at night, were able to record a loss of only 5.6 per cent. This percentage indicates the total loss occurring during the entire period of physiological weight loss.

By any of these methods the weight loss may be balanced by as great an intake of fluid as is lost so that the loss may be done away with entirely. Experience has taught us that the natural feebleness of digestion is entirely inadequate to cope with most types of food other than breast milk, and a weak breast milk comparing its component parts to that obtained after the infant has nursed at the breast for several weeks.

In the endeavor to control or modify the loss other than by any of the above methods, efforts were directed towards lessening the loss of water from the tissues without influencing the supply.

Under ordinary conditions, directly after birth, the infant is subjected to a temperature change amounting to 30° F., the difference between the temperature in the uterus of the mother, 99° F. and that of the lying-in room about 70° F. The chilling which is resultant upon this fall in temperature is further augmented by evaporation of the vernix casiosa, and the usual habit of placing the infant upon towels saturated in a mixture of blood and amniotic fluid.

The infant remains in these surroundings for about ten minutes.

Accurate stop watch observations were made at a large obstetrical service (the accoucheur not being aware that the time interval was being determined) and it was found that rarely was the interval shorter than ten minutes before the infant was finally placed in blankets.

To obviate this chilling, electric heating lamps were used. They were so placed that when held at a distance of 20 inches from the vulva of the mother, the infant would be born into an atmosphere of 99° F. The heat was maintained throughout the time the infant was allowed to remain upon the delivery table. The initial cry appeared to be just as lusty in those children who were exposed to heat as that of the infants whose skin received the usual chilling.

It was found that infants protected by heat sustained a lessened weight loss. As other important factors beyond our control modify the weight thereafter, the loss of weight during the first 24 hours alone was considered.

TABLE I

| WEIGHT | NUMBER | AVERAGE WEIGHT | AVER. ACTUAL LOSS | % LOSS |
|---|---|---|---|---|
| 8-9 lbs. | 32 | 8 lbs. 9 ounces | 5 ounces | 3.6% |
| 7-8 lbs. | 47 | 7 lbs. 8 ounces | 4.4 ounces | 3.6% |
| 6-7 lbs. | 41 | 6 lbs. 6 ounces | 3.5 ounces | 3.4% |
| 5-6 lbs. | 42 | 5 lbs. 10 ounces | 2.1 ounces | 2.3% |
| 3-5 lbs. | 7 | 4 lbs. 5 ounces | 2 ounces | 2.9% |
| Average | 169 | 6 lbs. 8 ounces | 3.4 ounces | 3.2% |

The weight loss observed in many infants in two[20] large institutions having active obstetrical services was used as a basis of comparison.

TABLE II

| WEIGHT | NUMBER | AVERAGE WEIGHT | AVER. ACTUAL LOSS | % LOSS |
|---|---|---|---|---|
| 8-9 lbs. | 34 | 8 lbs. 4 ounces | 5.3 ounces | 4% |
| 7-8 lbs. | 34 | 7 lbs. 4 ounces | 5.8 ounces | 5% |
| 6-7 lbs. | 30 | 6 lbs. 6 ounces | 4.1 ounces | 4% |
| 5-6 lbs. | 10 | 5 lbs. 7 ounces | 3 ounces | 3.4% |
| 3-5 lbs. | 16 | 3 lbs. 15 ounces | 5.1 ounces | 8% |
| Average | 124 | 6 lbs. 4 ounces | 4.6 ounces | 4.6% |

The unusually high percentage loss in infants weighing under 5 pounds in Table II, is similar to that found in the statistics of Dluski, Heidemann, Trepper, Héry, and Jaschke.[1]

Observations made of the rectal temperature changes occurring during the first ten minutes of life, showed an average drop of 1.1 degrees in 48 infants exposed to heat during this interval. A drop of 1.8 degrees was recorded in 40 infants not so protected.

No relationship was shown between the loss of weight and the

temperature change. One infant exposed to heat lost 12 ounces in 24 hours with a fall in temperature during 10 minutes of 2.4° F. Among the infants born under ordinary conditions, there was recorded a loss of 15 ounces, and a temperature change of 3° F.

## DISCUSSION

Rowntree[21] has shown that the higher the environment temperature the greater the water loss by evaporation from the skin. The capacity of air for holding water vapor increases with the rise in temperature.

Rubner[22] considers the humidity of the air as an important factor. Animals give off more water vapor in dry than in moist air, the temperature being constant, an increase of 200-300 per cent accompanying a decrease of relative humidity from 69 to 31 per cent.

As the losses recorded by Rowntree and Rubner occurred only during the time of exposure, the loss of weight occurring in the infant during the ten minute exposure to either or both conditions would be comparatively insignificant.

Observations have not been made in infants to determine the effect of temperature and humidity on the respiratory water vapor loss or the loss by insensible perspiration, or whether the chilling of the skin to which the newborn infant is usually subjected would cause a subsequent and continued increase in loss through these channels due to an increase in the metabolic rate. Further studies will be undertaken to determine the influence of chilling on the water vapor loss. In the absence of definite data, any explanation of the changes recorded would have to be purely hypothetical.

## COMMENT

In most newborn infants the loss of weight occurring after birth may be viewed with equanimity.

In those very small infants, particularly the prematures, the physician is often in difficulties to overcome the physiological loss which may assume proportions great enough to jeopardize life. Avoidance of the chilling to which most infants are exposed has been followed by an appreciable lessening of the loss. Maintaining the body surface temperature throughout the first day of life in conjunction with proper amounts of fluid by mouth may conceivably avoid the loss entirely.

## CONCLUSION

The loss of weight occurring during the first days of life is a physiological process.

Most infants directly after birth are exposed to temperature changes amounting to a fall of 30 degrees.

In 169 infants in whom this chilling was avoided there was an actual loss in the first 24 hours of averagely 3.4 ounces and a relative average loss of 3.2 per cent.

In 124 infants who were exposed to this temperature change, there was an actual average loss of 4.6 ounces and a relative average loss of 4.6 per cent.

The loss of weight in those infants who were used as controls (not being exposed to heat) was 43.7 per cent more than the loss sustained by those so exposed.

I wish to express my indebtedness to Dr. G. L. Brodhead for the privilege of allowing this study to be made, Dr. William Studdiford for the use of the records at Sloane Maternity Hospital, and to Mrs. James Guttman for her technical assistance.

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152 WEST EIGHTY-EIGHTH STREET.

# RADIUM AS A SUBSTITUTE FOR HYSTERECTOMY

## A Series of Operated Cases Reviewed with This Question in Mind*

By C .W. Woodall, M.D., F.A.C.S., Schenectady, N. Y.

THE problem of uterine bleeding is one which has received considerable attention in the medical literature during the last decade. In increasing numbers, these articles have dealt with the treatment of metrorrhagia by the use of irradiation, and especially the gamma radiation of radium. The results reported by Kelly, Clark, Keene, Crossen, Geechan, Scott, Taussig, and others seem to show that practically all cases of so-called idiopathic uterine hemorrhage, and the majority of cases of hemorrhage from myomata, (within certain age and pathological limits) may be best controlled by the use of radium.

The excellence of the results obtained and reported by these workers seem to indicate that a considerable proportion of cases upon whom we have performed hysterectomies in the past might at the present time be satisfactorily treated by radiation, thus conserving the uterus and not subjecting the patient to the risks of a major operation.

In order to get a more correct insight into the relative importance of surgery and radium in the treatment of uterine pathologic conditions it was deemed advisable to look over a series of hysterectomies with the idea of determining what proportion of these cases would now be treated by radium rather than by hysterectomy.

With this point in view I have reviewed a series of 132 hysterectomies performed between 1914 and 1922, during which time I have been associated with Dr. Stanton. One hundred and sixteen of these were supravaginal amputations and 16 vaginal hysterectomies. Analysis shows that these patients were operated for the following causes:

SUPRAVAGINAL HYSTERECTOMIES

| | |
|---|---|
| Myomata, including sub-serous, intramural and sub-mucous varieties | 67 |
| Myometritis with metrorrhagia | 15 |
| Endometritis—polypoid with excessive flowing | 7 |
| Carcinoma of uterus | 8 |
| Pelvic inflammatory disease with involvement of uterus | 9 |
| Prolapse—cervical fibroid | 1 |
| Epilepsy associated with menstrual period | 1 |
| Hydatidiform mole | 1 |
| Menstrual neurosis with excessive flowing | 1 |
| Pregnancy—ruptured uterus | 1 |
| Toxemia of pregnancy | 1 |
| Atrophic uterus with hemorrhage | 1 |

*Read before the Ellis Hospital Clinical Society in March 1923.

VAGINAL HYSTERECTOMIES

| | |
|---|---|
| Prolapsus uteri | 8 |
| Endometritis, polypoid with excessive flowing | 2 |
| Myometritis with hemorrhage | 1 |
| Ulcerated stump of cervix | 1 |
| Carcinoma | 1 |
| Retroflexed uterus with stricture of cervical canal | |

The primary mortality of these cases was 3 per cent (4 cases). The diseases for which these 4 cases were operated and the causes of death are as follows:

1. Enormous fibroid and cancer. Dying on 30th day.
2. Nephritis of pregnancy. Had refused any treatment other than hysterectomy. History of 5 previous pregnancies terminated by curettement because of kidney insufficiency.
3. Fibroid, dying of embolus on 10th day.
4. Fibroid with anal fissure. This anal fissure became infected during convalescence from the hysterectomy and a virulent cellulitis spread up through the perineum finally causing peritonitis and death.

The gross mortality in this series is only 3 per cent, and if we exclude the deaths due to the continuation of the diseases for which they were operated, we have in 130 hysterectomies only 2 deaths, one from embolus and one from a complicating infection of the rectum.

As the chief object of this study is to learn what cases might have been treated with radium and so probably would have been saved the loss of their uteri, let us turn for a moment to the consideration of the classes of cases which are most benefited by radium therapy and glance at some of the contraindications for the use of radium in utero.

To dispose of the contraindications first we find that radium should not be used:

(a) In cancer cases where the patient is in a cachectic or severely rundown condition. Radium will only hasten the end.

(b) In large fibroids the size of a four months' pregnancy or larger, and in tumors causing pressure symptoms.

(c) In cervical fibroids causing distortion of cervical canal.

(d) In young women where the amount of radiation necessary to accomplish the desired result would be sufficient to bring on an artificial menopause.

(e) In cases having an acute pelvic inflammation, or an abscess, or broken down and infected myomata, or calcified myomata.

We may list those cases where radium is indicated as follows:

(a) Simple fibroids of uterus proper, either subserous, intramural or submucous where the uterus does not extend above the umbilicus, in women who are approaching or who have passed the menopause.

(b) In endometritis and myometritis without complicating pathologic conditions necessitating a hysterectomy.

(c) In so-called idiopathic metrorrhagia.

(d) In early carcinoma of the uterus or cervix, whether or not a panhysterectomy is to be performed.

(e) As a palliative in inoperable carcinoma of the uterus and cervix.

In our series of 132 cases, I find that 103 fall incontrovertibly into the interdicted class.

There remain 29 which I believe could have possibly been cured by the use of radium without subjecting the patients to the risk and incidental discomforts of a hysterectomy. These comprise 11 cases of fibroids in women approaching or past the age of menopause, whose main symptom was hemorrhage, in uteri only moderately enlarged, and who had no complications contraindicating the use of radium; and 18 cases of hemorrhage due to endometritis or myometritis, uncomplicated by pelvic infection.

The above list represents a very conservative selection of cases for hysterectomy. We have always felt that hysterectomy should never be advised without very positive indications demanding this operation. I have not reviewed the cases simply curetted or treated medically in which we would now advise the use of radium, but it is our general impression that these cases far outnumber the cases in which hysterectomy was performed for conditions for which we would now advise radium.

We feel that one of the greatest practical fields for the use of radium is in benign uterine conditions of the type in which one would feel inclined to do a hysterectomy but yet hesitates because the severity of the disease or discomfort seems hardly to warrant such a radical procedure.

MEDICAL ARTS BUILDING, SCHENECTADY, N. Y.

# DENTAL CARE DURING THE PRENATAL PERIOD

W. N. Rowley, M.D., Huntington, West Virginia

In a previous paper[1] relative to the care of the teeth during pregnancy, the observations upon thirty cases were reported. The outcome of all uncompleted cases, included in that paper, was favorable. In the past few years the relationship between dental and medical conditions has been emphasized[2] by many valuable contributions to the literature.

Rosenow[3] and Meisser have conducted some valuable experiments on the dog. The lower cuspids of these animals were devitalized. After the pulps had been removed, bacteria in dense suspension were introduced into the pulp chambers. The canals were then sealed with impervious dental cement. These animals, as well as the control animals, were fed and cared for in a uniform manner. Five of the six dogs infected with streptococcus from the urine of patients with nephrolithiasis developed calculi. The bacteria were recovered from the stones, the kidney tissue and the teeth of these dogs and when a suspension of these bacteria was injected intravenously into rabbits, stone formations and crystallization in the tubules of the kidneys were noted. The selective affinity of these organisms was thus established. No such lesions were demonstrated in the control animals. Bumpus[4] and Meisser have shown that pyelonephritis may often be caused by focal infections harboring streptococci which have a selective affinity for the urinary tract. They have presented a series of twelve clinical cases with careful and positive animal experiments to check the clinical results. Full mouth roentgenograms and careful examination of the tonsils were made in every case. Those teeth showing evidence of periapical infection were removed. Usually devitalized teeth not showing pathology in the roentgenograms were also removed. Cultures from these teeth showed a green-producing streptococcus when no bony change was demonstrable by the x-ray. Pyelonephritis[5] was produced experimentally in rabbits by the use of strains obtained from these extracted teeth. The tonsils as a foci must be considered also and they recommend removal of the tonsils in cases of pyelonephritis of possible focal origin as an adjunct to the removal of periapically infected and devitalized teeth. Meisser[6] and Gardner have made cultures from 113 pulpless teeth which were questionable in the roentgenogram, that is, teeth which are considered negative by many, or in which there is so little evidence of infection that they are usually considered harmless; 21 pulpless teeth were cultured, which in the roentgenogram showed no evidence of infection. Every one of these teeth was found to be infected; 85 of the 134 yielded pure cultures of green producing

streptococci. Fitz,[7] writing on the preventability of certain cases of chronic nephritis, says, "Preventative measures against the development of true nephritis can be logically undertaken. Septic teeth and tonsils undoubtedly play a part in the speed with which the disease develops and should be removed." Rosenow[8] and Meisser have been able to produce nephritis in animals by infecting the root canals of devitalized teeth with organisms recovered from foci in nephritic patients. Talbot[9] has shown a rather definite relationship between foci of infection such as periapically infected teeth and placental infarction. This early infarction of the placenta, due to chronic infection, is the cause of early abortion in many cases. LaVake[10] believes that infected teeth and tonsils are a possible cause of nephritis in pregnancy, of preeclamptic toxemia and eclampsia. Talbot[11] believes that the presence of undrained chronic sepsis affects the efficiency of the excretory function of the kidney. A vicious circle is established. The toxins of chronic sepsis, by their inhibition of the kidney functions, causes a retention of the normal waste products of the body. In pregnancy this is a dangerous condition and often leads to serious toxemic complications. Talbot further states that the teeth harbor foci more commonly than the tonsils and concludes that all known foci of infection, when associated with pregnancy, should be removed.

This evidence condemning septic teeth is overwhelming, especially in reference to lesions of the kidney. In view of the dangers which may arise from the presence of dental infection, the condition of the teeth during the period of gestation demands careful investigation. In the course of a properly conducted prenatal regime every possible measure must be adopted to insure the health of the mother and child. It is not sufficient to examine the urine at uncertain intervals. Possible complications should be anticipated and preventative measures instituted early in the expectant period. Knowing the dangers of septic foci and the possible development of early abortion, early toxemia, nephritis, preeclamptic toxemia, eclampsia and postpartum infection, in the course of pregnancy, their removal becomes practically imperative. If the case is seen early this may be accomplished with safety, when preoperative preparation and selection of the operative field is given proper attention.

In a preliminary report thirty cases seen at the Mayo Clinic were reviewed. Some of these patients had not completed their gestational period. The outcome in these patients was favorable. The number of teeth extracted in the group of thirty, varied from eight cases with one extraction each, to one case with fifteen extractions. Eleven of these cases had extractions done in the first trimester. This is not in accord with Talbot's[12] opinion that the best time for extraction is after the fourth month. The method employed in handling these cases was not the same as used by Talbot. This fact has considerable bearing on

the cause for hesitancy in removing foci early. These early cases were principally cases of nausea and vomiting of pregnancy. Considerable improvement was noted in these patients following removal of the foci.

The care of the mouth during the prenatal period should be along definite lines, namely, full mouth roentgenograms should be made as a routine procedure;[13] these plates should be interpreted with the patient at hand in order that the other pathology in the mouth, especially of the gingiva, may be noted, as a dental checkup with the x-ray findings.[14] Clinical conditions, attendant symptoms and findings must be evaluated in the light of the pathology found in the roentgenograms.[15] Combined dental and medical judgment is necessary in determining the procedure in the individual case. This requires close co-operation between the obstetrician and the dental surgeon. In the determination of the offending teeth by the roentgenogram the teeth showing bony changes of a marked character with large abscess formation are not the sole cause of trouble in many cases. The x-ray has, in recent years, demonstrated many of the errors of dentistry. A high percentage of "saved teeth" have abscesses at the root ends. Gardner[16] believes devitalized teeth, with or without bone changes sufficient to cause shadows in the roentgenogram, are infected in a high percentage of cases.

When the diagnosis is made of the involved teeth, the next step is the selection of one or two teeth to be removed as the initial procedure where there are several to be extracted. When possible, upper teeth are selected first, because of the better drainage. The first extraction should be carried out in such a way as to produce the least amount of reaction in the patient. The first reaction acts as a vaccination in many cases and subsequent extractions are accomplished with practically no symptoms of absorption.

The preparation of the patient is the next consideration. The urine should be very carefully checked, the blood pressure noted, and elimination secured by mild laxatives. Special consideration of the blood chemistry is essential in the presence of kidney conditions, toxemia of pregnancy, hypertension, and acute or chronic conditions of infectious origin.

The type of extraction is of the greatest importance. The surgical method should be used in every case where apical infection is present sufficient to produce abscess and bony change. This method is more difficult of execution and is more time consuming, but has advantages far greater than any possible disadvantages.[17]

The surgical method described by Novitsky,[18] Shearer[19] and Gardner,[20] and others for the removal of apically infected teeth consists briefly in the following: Block anesthesia or infiltration with novocain depending upon the extent of the operative field involved. Incision of the labial gingival tissue, exposure of the external plate, removal of the external plate with the chisel to a depth sufficient to expose

the involved area. Elevation of the tooth and removal. Removal of the abscess and involved rarified bone and closure by suture of the gingival tissue. This leaves a clean field, reduces absorption and leads to rapid healing of the tissues.

The period of pregnancy at which extraction may best be accomplished is not easy to determine. When the pregnancy is normal and no symptoms are present which are referable to the dental condition extraction may be done at any time, preferably early. The progress of pregnancy produces well defined changes in the structure of the teeth and gingival hyperemia. The greatest prophylactic benefit is derived from early elimination of the foci.

When nausea and vomiting begins early and is controlled by simple measures the procedure is best postponed. After the fourth month these cases usually subside and extraction causes less distress. When the nausea and vomiting threatens to assume proportions of a hyperemesis no time should be lost in removing any foci of infection that might be a factor. Here careful management is necessary and should consist of rest in bed, checking the urine and blood pressure, and alkalinization. Dehydration should be combated and glucose and saline given per rectum. With this preparation and the surgical method of extraction no untoward results have been noted so far. The benefit in nausea and vomiting is worthy of this procedure. Too much emphasis cannot be placed upon the necessity of preparation and the value of the surgical method over the crude and less complete method of extraction and curettage. Roentgenograms of curetted areas have shown remaining abscess after simple extraction of the teeth. This procedure has been shown to be of questionable value, the infected tissue is traumatized and infection often spread rather than removed.

In the later months of pregnancy, when the patient has come for examination late, and shows no signs referable to foci, removal of periapical infections of a mild character are best postponed until after the puerperal period is past. The kidneys, in the later months, must receive especial attention and the presence of albumin in small quantities has disappeared after removal of the foci in the teeth.

Marked dental sepsis in the later months should be cleaned up. Oral sepsis is a real danger in the postpartum period and a potential cause of puerperal sepsis. Preeclamptic toxemia and eclampsia should always be considered a possible complication and it can be guarded against by proper care of the foci of infection. In the event that a chronic nephritic condition is present, which is aggravated by an acute nephritis superimposed, the removal of infectious areas is a very delicate procedure. Caution is essential. Careful preparation is necessary. Renal functions and blood retention must be studied. Elimination of the septic foci must be slow and gradual with careful observation attendant.

Abscessed teeth alone are not the only conditions in the mouth to which attention must be drawn. Prophylactic peridontia should be carried out in every case where the gingival tissue shows signs of pathologic involvement. Treatment should be instituted early in the period of pregnancy, and continued so long as the dental surgeon believes advisable. Further, cavity formation, although simple in character before pregnancy, is aggravated during pregnancy and vital teeth should be preserved. It is a well known fact among the laity, that dental decay progresses rapidly during the gestational period. This has led to the saying, "For every child a tooth." An aversion has also been built up against dental manipulation during this period. This is a fallacy. Dental caries should be treated. Permanent fillings in large cavities, inlay and bridge work, however, is often tiring to the patient and the results unsatisfactory because of the softened condition of the teeth. Temporary cement fillings are more advisable. Administration of calcium by mouth is valuable in the later months of pregnancy as a routine procedure. With this program for the care of the mouth, much good can be accomplished.

## SUMMARY.

The teeth as a source of infection in certain kidney lesions, is recognized.

The function of the kidney must be safeguarded during pregnancy.

Teeth showing evidence of periapical infection may be safely removed during pregnancy.

Co-operation of the dental surgeon in diagnosis and treatment is a necessity.

Preparation of the patient is essential.

Selection of the teeth to be removed is of importance.

Removal of the areas of infection should be by steps.

Surgical removal is the method of choice in most cases.

Local anesthesia is satisfactory in practically every case.

The period of pregnancy at which removal may be best accomplished depends upon the condition of the patient.

Early removal of the dental foci should be a part of every prenatal regimé.

Prophylactic peridontia is equally important.

Carious teeth demand attention.

Temporary dental fillings are more advisable than permanent work.

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# Society Transactions

## TRANSACTIONS OF THE AMERICAN GYNECOLOGICAL SOCIETY

FORTY-EIGHTH ANNUAL MEETING

*HOT SPRINGS, VIRGINIA, MAY 21-23, 1923*

*(Concluded from November issue)*

DR. JOHN FRASER, Montreal, read, by invitation, a paper on **Placental Circulation.** (See page 645 for original article.)

### DISCUSSION

DR. OSKAR FRANKL, VIENNA, AUSTRIA.—About the middle of pregnancy we see the epithelial cover of the villi still consisting of the Langhans cells and a layer of syncytial cells, followed toward the end of pregnancy, by the third stage of senility of the placenta. That is the time when the syncytial cell boundaries obliterate, and we see only a band of protoplasm. The physiology of the fetus has no doubt a close connection with these changes. It is very plain to anybody who has studied this question that physiologic involution of the surface epithelium must be very closely connected with the physiologic involution of the vessels of the villi. We can thus understand the physiologic loss of weight of the fetus in the last week of pregnancy.

DR. OTTO H. SCHWARZ, ST. LOUIS, MISSOURI (by invitation).—From Dr. Fraser's statement I assume he refers to the formation of so-called white infarcts as being due to the obliteration of the placental circulation.

Dr. McNalley in our service has been studying placental lesions intensively during the last year or so, and he comes to the conclusion that Young is right in his description of the red infarcts, and that the red infarct develops subsequently into a white infarct.

I have some sections which demonstrate the transitory stage from a red to a white infarct. In the red infarct the fetal vessels are dilated and contain much blood. The fetal circulation is apparently not definitely disturbed. Then follows the disappearance gradually of the syncytial cells with a deposition of fibrin in the intervillous spaces. The changes which occur in the uterine vessels which may be of significance in the production of so-called infarcts, I will bring out in the discussion of another paper.

Furthermore, in the consideration of the syphilitic placentae this lesion shows beautifully marked obliteration of the fetal circulation, yet it is well known that in a syphilitic placenta histologically there is no coagulation in the intervillous spaces, and the syncytial cells are present throughout. This, I believe, is a point against the fetal vessel origin of infarcts.

As a matter of interest I would like to mention another point which Dr. McNalley has brought out recently which, so far as I know, has not been previously described. In studying the placental end of the cord stained with Orcein-van

Gieson stain, he found that the vein in many instances had a very well developed internal elastic membrane. In about one-half of the cases this was rather perfectly developed, while in about one-fourth of the cases it was developed half-way, or slightly more, and in the remaining one-quarter somewhat to a less degree. The sections studied showed, in no instance, any definite attempt in the formation of an internal elastic membrane in the arteries; although in a few instances it existed in a poorly developed state. We have been unable to find similar descriptions elsewhere. This is exceedingly interesting when it is recalled that the umbilical vein carries arterial blood.

DR. FRASER (closing).—Dr. Schwarz has opened up quite a controversial subject when he alluded to the origin of these infarcts. In these very early senile changes, where the villi are otherwise fairly healthy, and the epithelium dead, we noticed an endarteritic change and a sort of dropsical swelling or edema of the stroma with a fibrinous change right in the core of the villus. I am not saying that is absolutely the case, but these pictures and some of the sections are suggestive of a primary vascular change.

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DR. NORRIS W. VAUX, Philadelphia, Pa., read by invitation, a paper on **Pyelitis of Pregnancy.** (See page 681 for original article.)

DISCUSSION

DR. CHARLES C. NORRIS, PHILADELPHIA.—It is difficult to discuss a paper in which you find yourself in almost complete accord. Dr. Vaux has covered the subject in a very comprehensive manner and his suggestions for treatment are conservative and excellent.

One of the chief points of interest is the etiology. Despite the statements of some authorities I cannot but feel that pressure, or at least constriction, of the ureter is a definite factor in weakening the local resistance. It has been pretty well proven that all these cases are hematogenous in origin, the colon bacillus group being the most frequent cause of trouble and staphylococcus or streptococcus occurring less frequently. A point of interest and an argument against pressure being an important etiologic factor is that pyelitis rarely occurs in conjunction with myomata, although hydroureter is by no means unknown. Perhaps the slow growth of the myoma may have something to do with this.

Clinically, we find pyelitis of pregnancy occurring in two types: (1) a moderately insidious onset, usually preceded by an albuminuria and generally due to colon bacillus and (2) acute cases, with sudden onset, often with severe symptoms, and often due to the staphylococcus or mixed infection. In eight cases recently seen by me, four were of the acute type and four of the more chronic form. The acute variety may readily be mistaken for appendicitis, calculus or even sepsis. The fact that there is generally tenderness over the renal area and pyuria should, however, lead to the correct diagnosis. On one occasion I removed a normal appendix in such a case due, I believe, to misinformation regarding a urine analysis. The similarity of an acute appendicitis is, however, very striking in some cases. As regards prognosis, the disease is rarely fatal and abortion also relatively infrequent. I have never had to empty the uterus for this condition. Treatment along the lines suggested by Dr. Vaux is generally effective.

I recall one case who had had two pregnancies, both terminated by spontaneous abortion, and who came into my hands early in her third pregnancy. In this case pyelitis developed as in the two preceding pregnancies, but rather energetic

treatment carried her to within two weeks of term when labor began, and a live infant was secured.

DR. FLOYD E. KEENE, PHILADELPHIA.—One important fact stated, is that it is impossible to give one specific cause as the etiologic factor in the development of pyelitis of pregnancy. In other words, there is the cooperation or combination of two or more causes that are active, and these may be constitutional or local in nature. Anything that predisposes to diminished resisting power on part of the individual will be an etiologic factor of importance.

So far as the active or immediate factors are concerned in producing pyelitis, I feel strongly that there are two which are necessary. The first is the presence of infection, and the second is some form of peripheral obstruction along the lower urinary tract. We know how common it is to find bacilluria in pregnant women. A normal kidney can secrete bacteria and show no effect from it, but if there is obstruction to the proper drainage of the kidney we have sometimes the development of infection and pyelitis.

I am also a strong believer in the hematogenous origin of kidney infections. Why it is we are not able to determine infections by positive blood cultures, I do not know, but I think both the experimental and clinical evidence point to the conclusion that such lesions are usually due to a blood-borne infection.

Infections in pyelitis of pregnancy are exactly the same as in the nonpregnant woman so far as the bacteria that are active are concerned. They again can be subdivided into the colon group and the aerogenes capsulatus, and less commonly the pyogenic organisms, such as the staphylococcus and streptococcus, and third, a combination of the two. This is in accord with experimental work that has been done more or less recently. For instance, an article which has appeared only in the last few months by Rosenow and Bumpus from the Mayo Clinic brings out the fact that in all probability the primary invader in causing the infection is either the staphylococcus or streptococcus. Kidney resistance is lessened, and the colon bacillus is a secondary invader, and because of its rapid growth the primary organisms lose their identity.

As far as their effect on the kidney substance itself is concerned, these organisms are different. The characteristic lesion produced by the colon bacillus is one that involves the straight tubules and pelvis of the kidney. Clinically, this is demonstrable because very early in colon bacillus infections we have pyuria. The typical sites for pyogenic organisms, streptococci and staphylococci, are found in the glomeruli and in the cortex. The lesion first brought out by Brewer of what he called acute, suppurative hematogenous nephritis is typical of the lesion. Cases must arise in the pregnant as well as nonpregnant woman where we are dealing with such cases as these. It is in these cases we have the patient hard-hit, giving symptoms of some acute abdominal catastrophe, with no pus in the urine. We find no pus, for the simple reason that the minute miliary abscesses are limited to the cortex of the kidney and have not broken through into the straight tubules and into the kidney pelvis. So much for infection. In addition to that, we must have peripheral obstruction. I think in a certain proportion of cases the uterus, by virtue of its pressure alone on the ureter, especially as it crosses the pelvic brim, may produce obstruction, but I am of the opinion that this is not true in the majority of cases. If one studies the bladders of these pregnant women cystoscopically, one is immediately struck with the absence of signs of infection, and with extensive distortion of the bladder base, which means distortion of the terminal ureter. These alterations can easily produce a partial occlusion of the ureter, and on passing a ureteral catheter, one can demonstrate the obstruction a few centimeters above the ureteral meatus. I am inclined to believe that in some cases the uterus, by virtue of its pressure, produces obstruction, but in the

majority of cases that is not so; the trouble is due to either distortion of the bladder or to edema of the terminal portion of the ureter.

As Dr. Vaux has mentioned, and as Dr. Curtis has pointed out in a recent paper, we commonly demonstrate residual urine in pregnant women which may be an important factor in the development of pyelitis. There may be urethral obstruction with the same results as in prostatics, leading to a ureteral reflux and later to a true pyelitis.

As far as treatment is concerned, I think we all realize that in the nonpregnant, 60 or 70 per cent of all acute pyelitis cases will recover under medicinal measures. Kidd, in his excellent monograph, has brought out this fact very strongly and clearly. The same holds true in the pyelitis of pregnancy, for the majority of patients get well with nothing but posture, rest, elimination and alkalinization of the urine. I have found in my own experience it is very seldom that the urine has been alkalinized. In other words, if we would get the effects of alkalinization we must administer large doses and continue to do so long enough. How the alkalization works I do not know. It has never been determined. It has been shown *in vitro* that it is possible to grow the colon bacilli in alkalinity even higher than we can possibly render the urine. Therefore, the old theory that alkalinization of the urine diminishes the growth of the colon bacillus is not true. I am inclined to believe that in all probability the alkalies act as diuretics and give better drainage, and thus allow the infection to take care of itself.

A certain group of cases will not respond to medicinal measures, and will require ureteral catheterization. This type is evidenced to a certain extent by symptoms of peripheral ureteral obstruction. I have found that this type of case responds beautifully to catheterization of the ureters, and the injection of some antiseptic, such as mercurochrome.

There is another type of case in which medicinal measures and ureteral catheterization have no effect whatever, and here we may be dealing with a cortical renal infection of pyogenic origin, due either to the staphylococcus or streptococcus. Under such circumstances the induction of abortion is a life-saving measure.

DR. ARTHUR H. CURTIS, CHICAGO, ILL.—First, irrespective of what part of the body is involved, failure to secure proper drainage is an exceedingly important factor in the maintenance of chronic infections. I am confident that the chief cause of pyelitis is contamination of residual urine, whether this residue be in the bladder, in the ureter (notably edema of the mucosa), or in the kidney. Either with or without a focus elsewhere, bacteria filter through the kidney with great frequency; or the urinary tract may become involved by bacteria which have ascended into the bladder. These two factors, a predisposing stagnation of urine combined with bacterial invasion, suffice to produce persistent infection.

Secondly, I agree with Dr. Vaux that infection is nearly always caused by bacilli of the colon group, which rarely produce spontaneous abortion. Sometimes, however, there is hemolytic streptococcus infection; and with invasion of the urinary tract by these bacteria there is not rarely an associated abortion or stillbirth.

DR. EDWARD A. SCHUMANN, PHILADELPHIA.—I entirely agree as to the treatment. We often find that tendency to overtreatment referred to in the management of pyelitis in pregnancy. These cases are too frequently approached primarily by ureteral catheterization and flushing out of the kidney pelvis with some solution. We have found in our experience at the Philadelphia Hospital and at the Jefferson Hospital that posterial treatment is usually sufficient. We prefer the Trendelenburg position and put the patient on a highly restricted diet, and if they do not yield directly to simple measures of this kind, there is usually present one

of two things, either as Dr. Keene has said, a distinct obstruction in the ureter (and I do not think it is due to pressure) or, a remote focal infection. It is our routine that when a case of pyelitis of pregnancy does not show distinct signs of amelioration within four or five days to make an extensive study of the patient with regard to foci or infection elsewhere, the tonsils and the teeth. There may be a chronic appendix which has been found causative in a number of instances.

As to the induction of abortion, I believe firmly with Ballantine who, in a survey of a series of cases of abortion in pyelitis, found that it occurred particularly in the fulminating cases that are ushered in by a chill and rapid elevation of temperature, and in which the fetus dies as a result of direct insolation.

DR. WILLIAM C. DANFORTH, EVANSTON, ILLINOIS.—I believe that the infection in pyelitis of pregnancy is of hematogenous origin; that obstruction has a great deal to do with it, and that retention of urine in the bladder, which Dr. Curtis has emphasized, is one of the most important factors. Occasionally there is mechanical obstruction of the ureter itself by the pressure of the pregnant uterus. On two occasions I have been able to demonstrate this with the ureteral catheter. The catheter passed above the level of the pelvic brim and could not be passed further when the woman was in the horizontal position, but on turning her upon her left side the ureteral catheter passed without difficulty. Some years ago, in our maternity we did a series of urinary examinations in infants. Examinations of catheterized specimens taken upon the first day of life, showed, in a fair percentage, the existence of a pyuria which we believed was due, in all probability, to pyelitis that existed at the time of birth. Abortion in some cases of pyelitis of pregnancy may occur as a result of the death of the fetus due to high temperature. We have had one case in which that has happened twice.

We have treated pyelitis cases conservatively for the most part, by using postural methods, together with water in large amounts and urinary antiseptics. We have reserved the ureteral catheter for those cases which have resisted the ordinary forms of treatment. I am not particularly enthusiastic about it, but there were two cases in which we were able to definitely effect a cure. We have left the catheter, as a rule, in about three hours.

DR. WILLIAM E. STUDDIFORD, NEW YORK CITY.—I wish to mention one etiologic factor in the pyelitis of pregnancy that I think is of some importance and not frequently mentioned. During the past year I have seen three cases of acute pyelitis developing after vigorous attempts at catharsis, where the constipation had become aggravated and where large doses of calomel were used. In cases of pyelitis the use of calomel on two occasions has aggravated the pyelitis, and I believe that frequently attempts at vigorous catharsis are the primary factor in the onset of the pyelitis, probably from irritation of the intestinal tract which makes it easy for the colon baccillus to cause infection of the kidney. Dr. Little in his postpartum care of women found that the use of vigorous catharsis produced a rise in temperature. I believe that the pyelitis which develops on the eleventh or twelfth day following labor is often caused by attempts to force the secretion of milk by taking too large quantities of cow's milk by the mother: with a resulting intestinal upset and constipation.

Another thing: Dr. Vaux in the treatment of these cases mentioned the Fowler position. Our experience has been that the Trendelenburg position or elevating the foot of the bed gives better drainage where pressure of the uterus is an obstructing factor rather than using Fowler's position.

DR. RUDOLPH W. HOLMES, CHICAGO.—For many years I have held that there were two types of pyelitis in the obstetric relation, one *in* pregnancy, and the other *of* pregnancy. We may generally find a history of repeated attacks of illness,

covering a period of years, diagnosed or not recognized, as a disease of the kidney. The anatomic changes incident to pregnancy offer favorable conditions for the lighting up of a more active process than formerly had obtained. Withal the pyelitis rarely produces active symptoms, as the woman has acquired a relative immunity to the bacteria responsible for the chronic, recrudescent form.

The pyelitis of pregnancy is a very different matter. Very often the onset is extremely abrupt, with very marked symptoms, pain and high temperatures, offering a sharp contrast to the chronic recrudescent form. Pyelitis of pregnancy may be very fulminating, with symptoms so masked that often the attack is misinterpreted. Most commonly the erroneous diagnosis of appendicitis is made.

Few will now question the opinion that commonly the cause is blood-born. We do not doubt that some cases are produced by an ascending infection from the bladder. We have had ureteral pressure ascribed as the cause of kidney involvement ever since Halbertsma declared eclampsia was due to this cause, and it did not take long to demonstrate the error. All the frozen sections of the pregnant or parturient women made by Winter, Webster, Hart and Barbour, and others have plainly shown that the anatomic conditions of the pregnant precluded pressure, just as the study of frozen sections demonstrated the fallacy of pressure in relation to eclampsia, so I believe it proves the erroneousness of the opinion of its being an etiologic factor in relation to pyelitis.

Dr. Curtis has contributed a very valuable bit of information when he showed us that stasis of the residual urine greatly contributed to the production of cystitis. The sagging of the bladder, even its saceulation during pregnancy, promotes residual urine. It is too plausible to be denied that an ascending infection may arise from cystitis.

The common opinion obtained a few years ago that pyelitis is generally an unilateral infection. Too many cystoscopic examinations, with ureteral catheterizations, have been made to believe this now. It generally is a bilateral infection, though often in the acute stage symptoms may be referable to one kidney.

I agree with Dr. Vaux that therapeutic abortion rarely is indicated, but I believe an interruption of pregnancy two to four weeks before term is desirable in those cases where improvement has not been marked.

DR. JOSEPH L. BAER, CHICAGO.—I should like to touch on these points in connection with this paper. First, as to the location of the compression. If the uterus exerts pressure at all, it is more likely to be above the pelvic brim where the ureter crosses the psoas and lumbar dorsalis muscles and not at the bony edge of the pelvic brim.

In the second place, a single urinalysis is never sufficient to rule out pyelitis. So often in the colicky attacks there is obstruction on the affected side, due to edema or a plug, the urine obtained is from the healthy side and is clear, but later, when the obstruction is released, the urine from the affected side changes the character of the urinalysis.

In the third place, the mere mechanical passage of the ureteral catheter in cases with obstruction and colicky pain is sufficient frequently to relieve the distress without any pelvic lavage. The obstruction is intraureteral with edema of the mucosa, and the passage of the catheter seems sufficient to release the mucous plugs that may be blocking the canal because of its decreased lumen.

DR. FREDERICK H. FALLS, Iowa City, read, by invitation, a paper entitled **Carcinoma of Bartholin's Gland with Report of a Case.** (For original article see page 673.)

DISCUSSION

DR. FREDERICK J. TAUSSIG, ST. LOUIS, MISSOURI.—Glandular metastases in these deep seated vulvar carcinomas occur early and are very extensive. The prognosis of a case of vulvar carcinoma is proportionate to the depth at which the malignancy originates. This type of Bartholin gland cancer is almost uniformly fatal. An operation may temporarily relieve the condition, but glandular metastases occur a year or two afterward and the patient dies. On the other hand, we have cases where the lesion springs from the labial skin, and these are of the everting and inverting type. The inverting type occurs usually in younger individuals and is quite malignant. The everting type usually develops upon the basis of a leucoplakic vulvitis, at a point where the skin is sclerosed. These cases in my experience are relatively benign, and I can record three five-year cures out of a total of six such cases, 50 per cent five-year cures. Of course, this material is small, but we are dealing with a condition that is rare. It indicates that this form of carcinoma gives a very different prognosis from the cancer that develops from Bartholin's glands.

DR. DEWITT B. CASLER, BALTIMORE, MARYLAND.—We have had in our clinic in Baltimore, beside the case of Dr. Kelly's, which Dr. Falls has just mentioned, three malignant tumors of Bartholin's glands, one a sarcoma, a second case of Dr. Kelly's of adenocarcinoma, and a third case of papillary cystadenoma, which shows malignant changes in certain places. The second of these tumors was operated upon by Dr. Kelly in 1907, for a prolapse of the uterus. At the time of operation, she was found to have a small tumor, about the size of the end of the thumb, in the labium on one side. This tumor was excised, and in the laboratory proved to be an early adenocarcinoma of Bartholin's glands. This patient is still alive and perfectly well.

It has always seemed to me rather remarkable that a gland like Bartholin's gland, constantly subject to irritation and trauma and repeated attacks of inflammation, should not show malignant changes more often. These three cases, which I have mentioned, have not been previously reported, and I thought it would be wise to make them a matter of record.

DR. FALLS (closing).—In connection with the treatment I did not mention the fact that we operated primarily on this case in March, 1922, and we used radium as soon as we found out it was malignant. I had her come back in May and used more radium, and then in July we did a radical removal of the glands of that same side, taking in the lymphatics, and cleaned out the inguinal region. This was done prophylactically, and there was no sign at that time of carcinoma in the glands or the tissues surrounding.

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DR. FREDERICK C. IRVING, Boston, Mass., read by invitation a paper entitled **Abdominal Hysterotomy under Morphine, Scopolamine and Local Anesthesia.** (For original article see page 688.)

DISCUSSION

DR. WILLIAM E. STUDDIFORD, NEW YORK CITY.—Dr. Irving's technic as described, appears most reasonable, and apparently very easy. However, it requires

absolute adherence to detail. His proposition of doing hysterotomy in these cases and the secondary sterilization is one that, I believe, is done too seldom. Many of these cases have been subjected often to simple abortion with repeated pregnancy, and increasing the cardiac or kidney disease. In the cardiac cases with decompensation, I believe the first contention to be advanced is that pregnancy should be ignored; that it is absolutely a medical proposition, and it has been rather surprising to me in the last three years, where we have followed this plan and have turned our cases over to the internist, how well they have recovered from their decompensation under appropriate treatment, how many of them can be carried to term, and the ease with which they go into labor.

With a small amount of morphine and scopolamine the first stage is easily carried through, and then helping these women during the second stage the results have been most satisfactory, so that we have had to do cesarean section in only one cardiac case, in which there was a marked pelvic deformity.

We have had 17 cases in which hysterotomy and sterilization have been indicated, in which local anesthesia, as described by Dr. Irving, could have been used. These include five in which the indication was a tuberculous condition, three in which there was cardiac disease, and six were hypertension or nephritic cases. All of these cases were brought into the hospital, subjected to a thorough medical examination, and put directly under the charge of a medical man.

As to their duration in the hospital prior to operation, the average stay for the tuberculous cases was six days; for the cardiac cases 17 days, and for the nephritic cases seven days. All of them were operated upon under general anesthesia usually, with a primary dose of morphine, followed by gas-oxygen in which a small amount of ether was given to obtain the primary relaxation. The rest of the operation was carried on under gas-oxygen anesthesia. In these 17 cases there have been no deaths. In all cardiac cases I am more and more convinced that they should be under proper medical care. Cesarean section and hysterotomy in primary pregnancy can be carried on. In the case of a second pregnancy, I believe if the cardiac condition has not improved in the interval, a hysterotomy and sterilization should be done early in pregnancy before signs of decompensation have developed.

DR. ARTHUR H. MORSE, NEW HAVEN, CONNECTICUT.—I have been particularly interested in Dr. Irving's paper, for during the past few years we have treated several cases along similar lines. Among these was a primipara, 37 years of age, who was admitted with preeclamptic toxemia and a heart which was on the verge of decompensation. Three years previously a nephrectomy had been done for renal tuberculosis. Upon the day of admission orthopnea was so great that she could not lie down and while the immediate termination of pregnancy was imperative any vaginal procedure was out of the question. Nor could a general anesthetic be safely administered. Accordingly, an abdominal cesarean section was performed under novocain anesthesia. We did not employ scopolamine as Dr. Irving has suggested, but gave the patient a fourth of a grain of morphia just before she was taken to the operating room.

I was impressed by the slight discomfort which this patient felt during the operation. She talked throughout the procedure and would not believe that her child had been born until she heard its cry. Moreover, she stated that were she to undergo a third operation she would prefer a local to a general anesthetic. During the past year a similarly favorable result was obtained with novocain anesthesia in the case of an elderly woman from whom an enormous ovarian cyst was removed. With regard to general anesthetics, we have, for the past year, employed oxygen and gas almost exclusively in all our gynecologic and obstetric work.

DR. GEORGE W. DOBBIN, BALTIMORE, MARYLAND (by invitation).—I have been profoundly impressed in the last few years with the efficacy of nitrous oxide anesthesia when administered by a thoroughly skilled anesthetist.

In the last year I have done four cesarean sections on women who were extremely bad risks, two cardiac cases with broken compensation, one diabetic and one patient operated on at the end of an acute lobar pneumonia.

DR. IRVING (closing).—There is one problem that has bothered us a great deal. All deaths were in the cardiac series, and there have been a certain number of cases admitted to the hospital badly decompensated and who have been under adequate medical care. In spite of that, these cases have not improved; at least, they have not become entirely compensated. Some of them have, for a time, improved, and then grown worse, and the problem was what to do with them. Rather than take chances of things getting into a worse state than they were, we have delivered these patients. We may have done the wrong thing. It was in that class of cases we had two deaths. What Dr. Morse had to say about this type of patient is very important. An intelligent woman, who can cooperate with you, does not require a preliminary dose of morphine and several doses of scopolamine, but I think in all cases it makes the operation easier for everyone. I want to state emphatically that the operation is more satisfactory not only for the patient, but for the operator if the patient's senses are not present.

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DR. OTTO H. SCHWARZ, St. Louis, Mo., read, by invitation, a paper entitled **Blood Pressure Changes Following Delivery.** (For original article see page 656.)

DISCUSSION

DR. HAROLD C. BAILEY, NEW YORK CITY.—One of the most interesting things to me is the very considerable number of cases Dr. Schwarz presents to us with a study of short duration. I think he is very probably right when he says that a drop in pressure is not unusual following delivery where the blood pressure is raised to any great extent. I was led to take up these observations when I joined the Bellevue Hospital Service in 1909. There were several cases of eclampsia that died on the table. We were using accouchement forcé by the method of bimanual dilation, the Edgar and Harris methods, and rapid delivery. Strange to say, those patients who succumbed at once did not do so, as far as we could determine, from any trauma produced in the uterus. In the first case of eclampsia in which I took blood pressure readings and pulse tracings, there was a drop of 100 millimeters of mercury and the patient died at once. Apparently it was not an uncommon proposition following immediate delivery in eclampsia.

To make our observations complete we worked out the matter; for instance, within a few months with the veratrum viride alone we saw the blood pressure drop 145 millimeters of mercury with the woman undelivered. With delivery alone, with no drugs, we presented a case in which there was a drop in blood pressure of 100 millimeters and in another a drop of 70 millimeters and both recovered. So, it seemed to me, clearly evident at the time, and I believe it now, that these cases should not have drugs as vasodilators of the type of either nitroglycerin or veratrum viride; there should be no bleeding until the woman is delivered and one knows exactly what cardiovascular reaction occurs, and accouchement forcé should be absolutely relinquished.

There is one other point in regard to the treatment Dr. Schwarz brought out, which is very important and that is the tight binder. I believe that we may

use sand-bags to the abdomen as was suggested by Hyde for use after laparotomies, and these would be a great help, because I feel certain that much of the trouble is due to the splanchnic dilation. Strange to say, I had a death two days after I received Dr. Schwarz's abstract. The patient had a blood pressure of 260 and had lost, two days before delivery, a pint of blood from accidental hemorrhage. She was growing worse rather than better, so labor was induced and later a moderately difficult version was done. There was some trouble in extracting the shoulders, and following delivery the patient went into shock and died on the table. She had a drop in blood pressure from 260 until it could not be read and yet, from the standpoint of trauma, there was only a tear through the cervical ring that extended a very short distance above.

I feel that this demonstration today ought to convince us that these women should be treated by the Dublin or Stroganoff methods or by modification of such methods and delivery should not be forced.

DR. WILLIAM E. STUDDIFORD, NEW YORK CITY.—Dr. Schwarz's presentation has brought up a condition that we have been tremendously interested in in the last few years at the Sloane, and have come to some pretty positive conclusions as to the handling of these cases. The question of blood pressure just prior to the onset of labor is very important, in the last months of pregnancy these cases with hypertension will have a rise in blood pressure at about the time of the menstrual period, with an increase in the albumen, with drops in the intermenstrual time, and at the onset of labor there is a distinct rise. That type of case is not suitable for operative procedure from below. Rapid delivery, accouchement forcé, induction of labor with bag, almost invariably leads to serious complications, and if delivery is necessary at the time, if there is no response to treatment our plan is to give them large doses of morphine as a rule. Cesarean section is a much better operation. Many of these cases occur in elderly primiparae or in multiparous women who have had difficult labors with a badly scarred and fibrous lower segment that does not easily dilate. Dr. Schwarz reports four cases in which there was rapid delivery by version with an enormous drop in blood pressure. The shock following such a procedure through the lower segment almost always brings about that result. Where a case has not progressed with an easy first stage with suitable dilatation of the cervix, I am more and more convinced that cesarean section will give us a better result and a lesser tendency to this drop than operative delivery through the vagina.

As to the bandage, we have been using for the past year or more in all cases of this type and especially in twin cases, where there is an enormous relaxation of the abdomen, a system of strapping, and the more we use it, the more we are inclined to increase the indications for it. We start with a tight wide strip of adhesive plaster across the pelvis, so that it goes well over from the trochanter across the lower border of the abdomen. These two strips of adhesive plaster are drawn up to the ensiform cartilage, then across the bandage and down to the anterior spine. The effect of that is to give control of the abdominal muscles, and there is less tendency at that time to interfere with relaxation of the abdominal wall, and it is a more permanent bandage than you can get with a tight binder.

DR. M. PIERCE RUCKER, RICHMOND, VIRGINIA.—There is one point in connection with the discussion of this subject that I think we have to bear in mind, and that is the remarkable variation in blood pressure in eclampties before delivery. If you take the blood pressure every five minutes you will find that it will drop and go back again, by at least 100 degrees of systolic pressure in the course of 15 or 20 minutes.

DR. CAREY CULBERTSON, CHICAGO, ILLINOIS.—I feel that Dr. Schwarz has explained a phenomenon which is frequent after labor. We have all seen symptoms of shock after normal labor whether the patients were toxic or not. The explanation appears to be that the drop in the systolic pressure is out of proportion to the drop in the diastolic.

As to the method of treatment in toxic cases, I am not sure but that the anesthetic which has been used in association with many of these methods of accouchement forcé has played a part in the production of this rapid drop in blood pressure, because in Webster's large series of cases of cesarean section in which there was no loss of mother or child, and many of which were done for a toxic condition, for eclampsia, none were lost. But this method was rapid delivery by cesarean section without a general anesthetic, using only local anesthesia with nitrous oxide gas in some cases, but never ether. There were no prolonged operations; the sections were done rapidly by the classical Sänger method. If the patients developed shock afterward they were stimulated. I do not recall that venesection was employed after abdominal section in this series.

DR. SCHWARZ (closing).—There were two autopsies on these cases of accouchement forcé, and in both instances the uterus was found intact. There was no great hemorrhage associated with any of the cases.

As regards cesarean section, a recent British survey has shown that eclampsia treated by cesarean section alone gives a high mortality, but it must be remembered that these cases were not treated under ideal conditions. One author in studying blood pressures after operation, and after studying also cases of cesarean section, found in cases of cesarean section in which there was no toxemia, there was no subsequent drop. At any rate, the drop was not of great degree. In a case of eclampsia there was a drop of from 160 down to 70 systolic. These cases were operated on under general anesthesia. If these operations were carried out by other methods, I feel sure they can be delivered with less traumatization and less resulting shock. These cases which I reported were neglected cases, many of them. They came to the service in late pregnancy, a few days before delivery or at delivery. There were only three who were observed in the prenatal clinic. One was a private case.

Regarding the remarks of Dr. Rucker, I have noticed before delivery that hypertension cases vary markedly in blood pressure, but never to such a great degree as he has stated.

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DR. JOSEPH BRETTAUER and DR. I. C. RUBIN, of New York, read a paper on **Hydroureter and Hydronephrosis.** (For original article, see page 696.)

# Department of Reviews and Abstracts

Conducted by Hugo Ehrenfest, M.D., Associate Editor

## Selected Abstracts

### Carcinoma of Genitalia

**Meyer R.: The Comparison of Certain Rare Benign and Doubtful Epithelial Changes of the Uterine Mucosa in Comparison with Similar Carcinomatous Forms.** Zeitschrift für Geburtshilfe und Gynäkologie, 1922, lxxxv, 440.

Much of the difficulty in distinguishing between benign and malignant epithelial proliferations of the uterus is due to lack of experience yet there are certain rare findings and borderline cases which may puzzle even the experienced pathologist.

*Endometritis glandularis* only rarely offers difficulties. The upper layers of the corporeal mucosa are so often cast off during menstruation that the inflammations only rarely lead to marked epithelial proliferation. A single case of gonorrhea gave rise to carcinoma-like invasion of the corporeal mucosa at so many isolated areas that from this and from the swelling of the epithelium the benign character of the proliferation could be determined, analagous to similar changes in the tube.

One case with a general *endometrial hyperplasia* showed numerous transitions from simple hyperplastic glands to carcinomatous ones, particularly in the basal layer. Two other cases showed the very earliest beginnings of carcinoma of multicentric origin in hyperplastic endometrium. In other cases, there were indefinite changes with slight piling of epithelium and cell changes. In one case, in a 19 year old girl, there was a question whether abnormal ovarian function might not have caused changes in the markedly hyperplastic mucosa which would ordinarily have been classified as carcinoma. In a number of cases, small carcinomata were found in a normally functioning mucosa without general hyperplasia.

*Hyperplasia of the cervical mucosa* may occur in conjunction with erosion, and caused in a number of cases deep adenomatous proliferations, where differentiation from carcinoma often was difficult.

*Squamous epithelial foci* occur in rare cases in the hyperplastic endometrium under the basal layer of the gland epithelium and push the latter forward into the lumen. They may even fill the lumen and cause atrophy of the opposite mucosa. Single foci may proliferate in the connective tissue or may displace this so that several gland chambers come in contact. Such structures are benign, but very similar ones may occur in large adenocarcinomata or in beginning very small carcinomata. Many-layered epithelium often occurs very diffusely in the adenomatous carcinomata. Sometimes it has destructive power of itself; in other cases, it seems rather to cause degeneration of the carcinomatous tissue.

*Carcinoma in endometrial polypi* is relatively rare, in cervical polypi the author knows of only one case. Gland structures of such extraordinary form and branchings, and occasionally with proliferation of the epithelium which in a diffuse form would necessitate the diagnosis of malignant adenoma without hesitation, may be

quite harmless when they occur in polypi; therefore, it may be important to recognize small polypi by curettings. *Epidermization in benign polypi* is often more marked than in erosions and may lead to error even more easily.

*Papillomata of the corpus* are, in spite of a benign appearance in one case, probably always malignant. In the cervix even giant papillomata may be benign and resemble polypi.

*Diffuse hyperplasia of the papillae* and small circumscribed papillomata which resemble pointed condylomata may occasionally be found on the vaginal portion of the cervix.

Since clinical experience is the basis of histologic evaluation, a correlation of the clinical and histologic findings and cooperation of the clinician and pathologist are of the utmost importance. MARGARET SCHULZE.

**Martzloff, K. H.: Carcinoma of the Cervix Uteri. A Pathological and Clinical Study with Particular Reference to the Relative Malignancy of the Neoplastic Process as Indicated by the Predominant Type of Cancer Cell.** Bulletin of the Johns Hopkins Hospital, 1923, xxxiv, 387.

Martzloff sums up his article as follows: The cells seen in epidermoid cancer of the cervix fall morphologically into three large groups; transitional, fat spindle, and spinal cell groups. The vaginal mucosa was involved in over 50 per cent of all the carcinomas of the cervix in this series, irrespective of the extent of the cervical involvement. Secondary involvement of the corpus uteri in cervical cancer occurred in 41.3 per cent of the cases in which the entire length of the cervix was involved. One third of all the patients seen during the first six months of symptomatic diseases, with the exception of those suffering from the spinal cell type of cancer, had extension of the neoplastic process to the broad ligament. Less than 10 per cent of the patients with broad ligament involvement lived more than one year after operation. The first symptom of disease in almost 85 per cent of the cases studied was some form of unusual vaginal bleeding. In 97 per cent of the cases some form of unusual vaginal discharge (either bleeding or leucorrhea) was the primary symptom. Of all the cancers in this series 52.1 per cent occurred between the ages of 36 and 50 years inclusive.

Of the patients between 31 and 35 years inclusive, 18.6 per cent are living and well today. This is the highest "cure" incidence for any five-year age period in this study. Of these patients 5.4 per cent gave a history denying pregnancy at any time, or any form of vaginal instrumentation. In 58.8 per cent of the patients operated upon where broad ligament induration was noted on physical examination, this signified carcinomatous extension. The incidence of "cures" is almost twice as frequent in the cases treated by abdominal panhysterectomy as compared with those in which a vaginal panhysterectomy was performed. The total operability of the cases in this study is 46.5 per cent, the total operative mortality is 14.2 per cent. The operative mortality prevailing in this clinic at the present time is between six and seven per cent.

Preliminary curettage performed several days prior to the radical operation for cancer was the procedure employed in 36.8 per cent of the patients who are now living and in good health. From this we would conclude that a diagnostic curettage not immediately followed by a radical operation for extirpation of the malignant process does not by any means render prognosis hopeless.

Inoperable cancer of the cervix is striking by its presence during the early period of the disease in the transitional and fat spindle cell types of cancer, and by its relative infrequency before the fifth month of the disease in the spinal cell type and in the adenocarcinomata. The incidence of the patients operated upon and traced who are living and well today is 18.7 per cent. The incidence of so-called

"five-year cures" is 26.6 per cent. In this study we have encountered no epidermoid cancer of the cervix which conforms to the basal cell cancer of the skin in regard to its apparent lack of malignancy. The histomorphology of the predominant types of cells in epidermoid cancer of the cervix is important, in that it indicates the relative malignancy of a given tumor. In this study the spinal cell type of cancer proved to be the least malignant. The transitional cell type is next in order of increasing malignancy, and the fat spindle cell type of cancer has proven to be the most malignant of all. The adenocarcinomata, as far as relative malignancy is concerned, fall in between the spinal cell and transitional cell groups of epidermoid cancer. The presence of epithelial pearls is significant only when they are associated with cancers of the spinal cell type. They then appear to indicate a lessened malignancy of the cervical new growth. C. O. MALAND.

**Mattmüller: A Contribution to the Statistics of Genital Carcinoma.** Zeitschrift für Geburtshilfe und Gynäkologie, 1922, lxxv, 106.

The author analyzed 620 cases of genital carcinoma treated in the Women's Hospital at Basel in the years 1899-1918. The age of the earliest symptoms showed a maximum number of cases at 50 years with a gradually decreasing number for each five-year period above or below this. Thirty-three per cent of the women were in the period of sexual activity, 37 per cent in the climacteric (46-55), and 30 per cent in the post climacteric period. The age of appearance of fundal carcinoma averaged 55 years.

Cervical carcinoma formed 71 per cent of cases, fundal carcinoma 15 per cent, tubal and ovarian 8 per cent, vulvar 3 per cent, vaginal 3 per cent. Fertility seemed an important factor. The average fertility of 2600 healthy women of 20-45 years was 3.4, but of 404 cervical carcinomata 4.4, of 93 fundal carcinoma 3.8. Women with very many pregnancies showed a special predisposition to cervical carcinoma; thus of 56 women who had had ten or more labors or abortions, 54 had cervical carcinoma and only two fundal carcinoma. Thirty per cent of the cases of fundal carcinoma were nulliparæ. The influence of dystocia and lacerations was difficult to calculate. Cervical carcinoma complicated labor 5 times in 27,245 confinements.

The influence of previous gynecologic disease is difficult to estimate. Prolapse and descensus are, contrary to what one might expect, very rare in combination with carcinoma of vulva, vagina or cervix. Endometritis is rare as a forerunner of fundal carcinoma, though myoma and fundal carcinoma occur in conjunction rather frequently. Long standing pruritus vulvæ was found in a number of cases of vulvæ carcinoma. Only 4 cases of 46 ovarian carcinomas gave a history of previous treatment of a cyst, though many authors ascribe a large number of ovarian carcinomata to malignant degeneration of a serous cystoma.

A familial history of cancer was found in 17.1 per cent of cases.

The duration of life in cervical carcinoma in the inoperable cases was 16 months; in the operable cases, including the primary mortality 15 months, excluding it, 22 months. For fundal carcinoma, the corresponding figures were 13 months, 21 months and 34 months.

The cause of death was cachexia in 69 per cent of all cases, in 77 per cent of the inoperable cases. The next most frequent causes of death were pneumonia, uremia, peritonitis, pyelonephritis, embolism and ileus. MARGARET SCHULZE.

**Leitch, A.: Vaginal Involvement in Cancer of the Cervix.** British Medical Journal, 1922, No. 3224, p. 686.

The author calls attention to the liability of cancer of the cervix uteri to extend down the vaginal wall. Postmortem examination of several hundreds of

cases showed that in 97.5 per cent the vagina was more or less extensively involved; in fact, it was the commonest of all the findings at autopsy. Involvement of the parametrium, of the interiliac lymph glands, and the occurrence of hydronephrosis were indeed less common. His argument is that these naked-eye appearances, found postmortem are an indication of the microscopic spread that would be taking place during life. But in addition to such evidence, he has frequently found lymphatic involvement in operation specimens where a vaginal cuff had been removed, and he holds that Wertheim, in advocating the removal of a portion of the vagina in order to enclose the septic cervix, had thus unconsciously done a greater service to radical treatment. Such vaginal removal, however, is not sufficiently thorough. The author in pursuing these investigations had on some occasions encountered irregular proliferations of the vaginal mucosa penetrating the underlying tissues, early epitheliomata in fact, which were quite distinct from lymphatic spread, and he suggests that these were due to the same cause, possibly an endogenous irritant, which had produced the original malignant tumor of the cervix. They were later in manifesting themselves, probably because the vaginal epithelium was more resistant to the causal agent.

F. L. ADAIR.

**Kano Moukaye: Neoplasms in the Cervical Glands.** Gynécologie et Obstétrique, 1922, v, 39.

The writer's general conclusions are: There exists a variation in proliferation of the cervical glands between the normal, the adenoma and the cylindrical type of cancer. Chronic inflammations of the cervix seem to be the principal cause of these hyperplasias which continue independent of the infection. True adenoma of the cervix is a proliferation limited to the cervical glands which preserve their normal type and their mucous secretion. This proliferation is benign. There are two histologic types, the lobulated and the papillary. The former has a more marked tendency to malignant transformation. There exists a form of adenoma which appears to infiltrate, and histologically is an intermediary between the adenoma and cylindrical carcinoma. The cylindrical cancer usually takes its origin in the adenoma. They are characterized by the absence of the mucous secretion and by karyokinetic figures. Practically the extirpation of all cervical adenoma is indicated.

F. L. ADAIR.

**Wharton: Rare Tumors of the Cervix of the Uterus of Inflammatory Origin.** Surgery, Gynecology and Obstetrics, 1921, xxxiii, 145.

Wharton describes condylomatous growths of the cervix, of which there are two types, gonorrheal and tuberculous. The symptoms are practically identical, namely profuse vaginal discharge which may be blood tinged. Both history and clinical findings may resemble cancer.

Gonorrheal condylomata may be single or multiple and, as a rule, show intense inflammatory reaction. Their cure consists in cleaning up the causative focus of infection, usually located in the cervical glands, and removing the growths. The endometrium is usually not affected and curettage is not advised.

Tuberculous condylomata are always accompanied by other manifestations of the disease. There is usually an accompanying tuberculous endometritis and salpingitis. The extent of the infection as a whole should be studied most carefully, and the operative treatment based on general findings.

The prognosis is universally good in the gonorrheal form, and in the tuberculous depends entirely on the concurrent infection. Two cases of gonorrheal and one of the tubercular variety are described.

R. E. WOBUS.

**Siredey: Early Diagnosis of Uterine Cancer.** Paris Médical, 1922, xii, 351.

The youth and apparent good health of the patient, as well as the absence of marked cervical lesions, often lead the physician astray. Siredey calls attention to the fact that cancer of the uterus is by no means rare before the age of 35 years.

While bleeding is the most constant symptom of both cancer of the cervix and the body, it may be very insignificant or may consist only of a bloody "hydrorrhea". In carcinoma of the cervix, a certain rigidity is sometimes noted which, especially if examination produces bleeding, is very suggestive. In cancer of the body, blood may often be expressed from the uterus by squeezing the body between the examining fingers.

R. E. WOBUS.

**Coopman: A Case of Uterine Carcinoma of Unusually Long Duration.** Nederlandsch Tijdschrift voor Geneeskunde, 1922, ii, 1844.

Coopman reports the case of a woman 50 years of age who had a fibroid removed in 1909. Malignancy being suspected, a radical operation was contemplated, but since the patient took the anesthetic poorly only a supravaginal amputation was done. Carcinoma was found in the extirpated uterus. In 1912 Coopman saw her. She then had an inoperable carcinoma, which he cleaned out by means of curette and scissors. On ten subsequent occasions she applied on account of bleeding, and at each time the masses were simply removed by the finger, since instrumentation had caused free hemorrhage at the first operation. No other treatment was administered.

Her general health remained good until 1919, when she died rather suddenly after an illness of two days. Necropsy was not permitted.

R. E. WOBUS.

**Worthington: Neoplasmata of the Clitoris.** Southern Medicine and Surgery, 1922, lxxxiv, 234.

He reports a case of carcinoma of the clitoris. In 1917 Battey collected from literature the reports of 23 cases of carcinoma of the clitoris for the preceding 12 years. The condition is more common in multiparæ than in nulliparæ but is serious in both, owing to the abundant lymph supply to the pelvic nodes. Dissection of the superficial tissue of both groins, the suprapubic fat and glandular tissue must be made with the removal of the tumor itself.

W. K. FOSTER.

**Van Dongen: Two Remarkable Cases of Metastatic Ovarian Cancer.** Nederlandsch Tijdschrift voor Geneeskunde, 1922, i, 1630.

Metastatic ovarian cancers, formerly thought to be rare, are being reported more and more frequently.

The first case here reported was bilateral and occurred in a woman aged fifty-six years who had passed the menopause five years previously. It was secondary to carcinoma of the appendix. She withstood operation, but died 8 months later of ileus.

The second case was unilateral and occurred in a woman of thirty-eight years. She had had a gastroenterostomy done previously for gastric carcinoma and came under the care of the author during pregnancy. It was decided, in view of her hopeless condition, to let her go to term and perform cesarean section in order to save the child. However, she went into labor at six months. Even at this time the prolapsed ovarian tumor prevented the passage of the fetal head and craniotomy had to be performed. The patient succumbed three weeks later to her original trouble.

R. E. WOBUS.

**Goodrich: Primary Carcinoma of the Fallopian Tubes.** Long Island Medical Journal, 1922, xvi, 1.

A married woman aged forty-four years presented herself suffering from a subacute arthritis of both knees. No primary focus of infection was demonstrable. Since the age of thirty-nine her periods had became less and less frequent. She had noticed an occasional slight gush of thin fluid from the vagina having an odor resembling that of urine. At times this discharge was tinged with blood. On examination, the left fallopian tube was found to be exquisitely tender.

One year later, she returned complaining of an exacerbation of her arthritis, as well as of frequent cramplike pains in the left lower quadrant. The tube was now found to be definitely enlarged and even more tender than before. At operation, both tubes were removed. The right was found to be normal, the left was enlarged and contained a cauliflower-like growth which had replaced most of the normal epithelium. Microscopic examination confirmed the diagnosis of carcinoma.

Goodall believes with Ewing that chronic inflammation is the most important etiologic factor in the production of carcinoma of the tubes. In 160 cases so far reported, intermittent blood-stained watery discharge was the most constant symptom. Over 50 per cent of these cases occurred in women between the ages of forty and fifty years.

R. E. WOBUS.

**Achard, H. P.: Complete Anuria in Cervical Cancer Treated by Ureteral Catheterization.** Le Progrés Médical, October 28, 1922, p. 503.

The author reports a most interesting case of inoperable cancer of the cervix in which there suddenly developed anuria. Cystoscopic examination showed the left ureter to be completely obstructed. A No. 14 catheter passed easily up the right ureter and relieved the hydronephrosis. This procedure was carried out on the day following the suppression of urine and repeated daily for eleven days. After that the right ureter continued to functionate until the death of the patient which occurred about two months later.

The author feels that this procedure should always be attempted in case of cervical cancer complicated by anuria, as the procedure is without danger and may yield excellent results.

T. W. ADAMS.

**Phillipowicz: Combined Abdominosacral Technic for the Radical Operation of Carcinoma of the Vagina.** Zentralblatt für Chirurgie, 1923, l, 793.

On account of the rich lymph supply of the vagina, extension of the carcinoma of this organ is very extensive and occurs early. For this reason operative cures are almost unknown. Heretofore two methods of approach have been employed, the perineal and the sacral. Phillipowics employed a combined abdominal and sacral method on a patient who has now remained well for one and a half years since operation.

The first stage of his operation consisted in opening the abdomen, moblizing the pelvic colon, and dissecting the uterus and parametria. The ovaries were left behind, as the tumor occurred in a young woman of twenty-eight years. The pelvic peritoneum was then sewed together leaving the pelvic organs extraperitoneal. The abdomen was then closed, no organs having been removed. The sacrum was next resected and the uterus, posterior and lateral walls of the vagina, and rectum removed *in toto*. The sphincter and anus were left intact, and the upper end of the rectum united to the anus. The wound was closed with drainage and healed *per primam*. Except for an ascending pyelitis and later, a moderate prolapse of the rectum which yielded to cauterization, the patient made a good recovery.

R. E. WOBUS.

**Brechot: The Treatment of Uterine Cancer.** Le Progrès Médical, June 18, 1921, p. 287.

Brechot emphasizes the importance of an early diagnosis as an essential factor in any successful procedure. He advocates the employment of a biopsy or diagnostic curettage in any case where there is the slightest suspicion of malignancy.

Using as the basis of his classification the stage to which the growth has advanced, he places in the first group those cases in which the uterus is freely movable. With these, immediate operation is the procedure of choice. In cases in which the mobility of the uterus is diminished by the presence of a nonmalignant inflammatory infiltration of the parametrial tissues, Brechot employs a preoperative application of radium. Three tubes, each containing 20 milligrams of radium, are placed in a collar-like fashion around the cervix. The average length of exposure is thirty-six hours. When the malignant process has extended beyond the limits of the uterus, the case is considered nonoperable and radium application is advocated as a palliative measure.

Where surgical procedure is indicated, the operation of choice is the radical abdominal operation as described by Wertheim. In order to avoid contamination of the peritoneal cavity, Brechot uses iodine water douches on the day preceding the operation, and a thorough application of the actual cautery to the cervix before opening the abdomen. Following the operation he advocates the application of 20 milligrams of radium over a period of twenty-four hours as an added precaution against recurrence of the process. T. W. ADAMS.

**Faure, J. L.: Treatment of Cancer of the Cervix of the Uterus.** La Presse Médicale, 1923, No. 41, p. 461.

The author reviews the development of the treatment of this lesion from his student days, when it was considered to be absolutely inoperable, to the present day of radium and surgery, singly or combined, with cures in varying percentages reported from various clinics. He performed his first abdominal hysterectomy in 1896, and one of his cancer patients, operated upon in 1899, is still living.

In 1910, radium entered the field, and Faure first began to employ it after operation, to destroy cancer cells that might have been left in the pelvis. In 1913, he observed a remarkable cure in a woman in whose case the inoperability was established by laparotomy. She was treated with a large quantity of radium, almost 50 centigrams, left in place for two days. The patient is still living and is perfectly well. After this, Faure treated the majority of his inoperable cases with radium, with fair results.

The author's personal experience with radium is as follows: 100 patients were treated with radium alone; 50 of them for recurrences, in whom little benefit was expected or obtained. Of the others, 25 were operable (but were not operated upon on account of serious physical defects), and 25 were inoperable. Only 5, or 10 per cent, are at present in good health; of these, one was clearly inoperable, two were borderline cases, and two were operable. Of the cases which were operable or borderline, these 4 represent 16 per cent; a fair figure, but only two years have expired since the treatment. In another series, 44 patients were given postoperative radium treatment; of these, 22 or 50 per cent, have developed recurrences, while in an earlier series, without postoperative radiation, 60.86 per cent are free from recurrences. The reason for the higher percentage in the radiated patients is not known. Faure believes that late recurrences are more often encountered after treatment with radium alone than after operation alone; here recurrence after the second year is rare. He has noted that occasionally radium can convert an inoperable case into an operable one; the operation should be performed in 4 to 6 weeks after radiation, in order to avoid the dense connective tissue encountered later.

Turning to his operative results, he found that of 102 private cases, 11 died following operation, a primary mortality of 10.88 per cent. Two died within a few months of causes independent of the operation. Of 96 cases operated upon more than one year ago, 13 have died as noted, 42 are cured, and in 41 the cancer has recurred. Dividing these cases from the point of view of operability into good, borderline, and bad, the results are as follows: Good (21 cases), mortality, 4.76 per cent, cures, 75 per cent, recurrences, 25 per cent; borderline (35 cases), mortality, 85.72 per cent, cures, 62.5 per cent, recurrences, 37.5 per cent; bad (40 cases), mortality, 22.5 per cent, cures, 19.35 per cent, recurrences, 80.65 per cent. Combining the good and the borderline cases, there was a primary mortality of 7.14 per cent, with two-thirds cures and one-third recurrences. The author considers these results superior to those so far obtained with radium, so that he prefers operation in favorable cases, in spite of the figures of Recasens and of Kelly.

He concludes that radium should be used in inoperable cases as a palliative; occasionally a cure will be obtained. For the other cases, he prefers operation if the surgeon has developed a skillful and careful technic, if the operation is sufficiently extensive, and if it is rapidly executed. If the work is completed in an hour or less, nearly all the patients will recover; if it takes two hours, one-half will be lost; if the operation lasts three hours, none will survive. E. L. KING.

**Mallet, Lucien: Treatment of Cancer of the Uterine Cervix. Necessity of the Association of Radium and Deep X-ray Therapy.** La Presse Médicale, 1923, No. 25, p. 289.

The author is of the opinion that deep x-ray therapy alone, given through multiple portals of entry, does not suffice; it is particularly efficacious in reaching parametrial involvements and extensions to the lymphatic nodes, but is not quite so certain in its action on the cervix itself. Here radium is especially effective, but it is well known that its destructive action on cancer cells extends for a distance of only 3 cm.; further efficacy is obtained only by using doses so large that the vesical and rectal mucous membranes are profoundly irritated. He estimates that for an early basal cell epithelioma (which is particularly susceptible to radium) a dose of 45 to 50 millicuries is necessary, which is spread out over 5 or 6 days. If the histologic examination shows the cancer to be of the spindle-cellular type, which is more radioresistant, the application may be advantageously extended over a longer period of time, even 25 days (Nobias), but employing only 10 mg. of the element, so as to obtain the same total dose. Of course, the field of action of radium can be extended by placing multiple small doses (2 mg. element) in the broad ligaments through an abdominal incision.

The disadvantages of deep x-ray therapy are (1) risk of developing "radioresistance" (2) excitation of cells at a distance; (3) danger of a grave general reaction. Radium produces only a slight systemic effect, or none at all, but its limited field is its disadvantage, hence the desirability of combining the two methods.

The author is opposed to the fairly common practice of treating with radium and then operating three or four weeks later, as he is sure that recurrences are more frequent than after operation alone, except in the spindle-cellular type. This type is senstitive to radium, but resistant to the x-ray, and hence is better handled by radium and surgery, in spite of the risk of recurrences and of implantation metastases. In other types, he feels that a combination of radium and deep x-ray therapy is the best treatment in the great majority of cases. E. L. KING.

**Mahle: The Morphological Histology of Adenocarcinoma of the Body of the Uterus in Relation to Longevity.** Surgery, Gynecology and Obstetrics, 1923, xxxvi, 385.

Of 855 cases of carcinoma of the uterus observed at the Mayo Clinic, 186 or 29.7 per cent were situated in the body. Mahle divides these into four groups according to MacCarty's standard of cellular differentiation, Group I consisting of the most highly differentiated tumors (malignant adenomata), while Group IV consists of tumors in which the cells show no differentiation whatever, the other two groups being made up of intermediary types.

The difference in the postoperative outcome was quite marked between the several groups. Of Group I all were alive, while in Group IV all had died from recurrence. The greatest number (61.29 per cent) were in Group II of which 72 per cent of the patients traced were alive.

Mahle concludes that the more favorable outcome of corpus carcinoma is due to the fact that most of these growths are of a high degree of differentiation and that a relative prognosis may be made from the histological structure of the tumor.

R. E. WOBUS.

**Sunde: Chorioepithelioma malignum.** Acta Gynecologica Scandinavica, 1921, i, 16.

A clinical and pathological study is made of 38 cases of chorioepithelioma and 240 cases of hydatid mole. Of the 38 patients with chorioepithelioma, 26 died, a mortality of 68.4 per cent; however, only 18 of them were operable; hence, with 12 cures, the incidence of cure was 67 per cent. Of the 26 lethal cases, 10 followed hydatid mole, seven abortion, 8 occurred after normal birth and one was found after an ovarian pregnancy. Of the 12 cured cases, 11 followed hydatid mole and one occurred after an abortion.

Sunde believes that hydatid mole occurs two and one-half times as frequently as normal pregnancy in the age group above 40 years and chorioepithelioma occurs three times as often as normal pregnancy in this same age group. This might be interpreted to mean that the older woman has difficulty in resisting the invasion of fetal cell elements. The percentage of multiparae is nearly twice as great among patients with chorioepithelioma as among those with normal pregnancy. Approximately 40 per cent of chorioepitheliomas arise from hydatid mole but only 5 per cent of the patients with hydatid mole develop chorioepithelioma. The first and most constant symptom, genital hemorrhage, usually begins within a few weeks or months after pregnancy. The diagnosis of chorioepithelioma malignum may offer the greatest difficulty, since the microscopic examination often neither permits a positive diagnosis nor excludes the possibility of the tumor. The clinical examination must be supplemented by an intrauterine digital exploration. When in the uterine cavity there is found a fixed projecting tumor of soft, elastic consistency like placental tissue, the uterus should be extirpated. The only correct treatment for chorioepithelioma is vaginal hysterectomy.

J. P. GREENHILL.

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# Item

## American Association of Obstetricians, Gynecologists and Abdominal Surgeons

The next regular meeting will take place in Cleveland, Ohio, on September 18th, 19th, and 20th, 1924. President, Dr. James F. Baldwin, Columbus, Ohio; Secretary, Dr. James E. Davis, Detroit, Mich.

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